JULY, 1944

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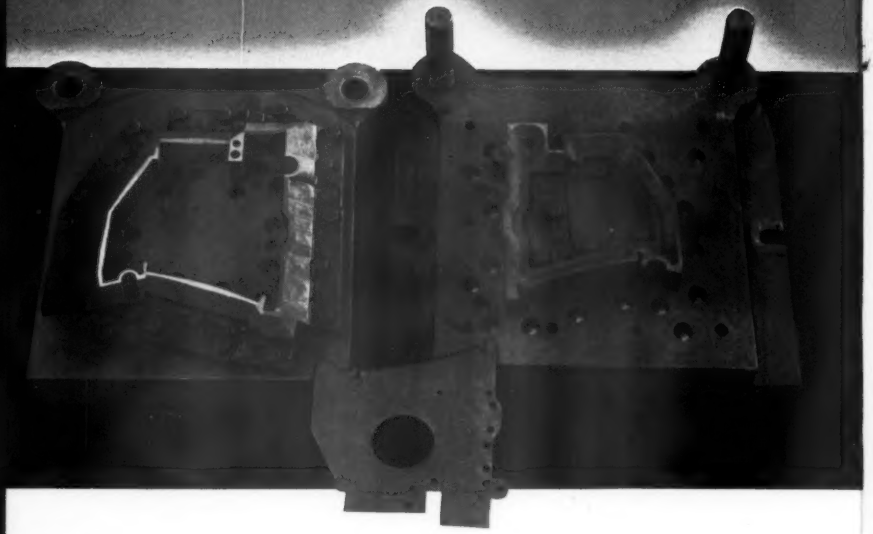

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GEORGE J. HUEBNER • EDITOR, PUBLISHER

Technical Editor, E. WILLARD PENNINGTON **Assistant Editor, PAUL L. REED**

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The Tool & Die Journal is published monthly for those industry key men who are responsible for designing, building and using precision tooling

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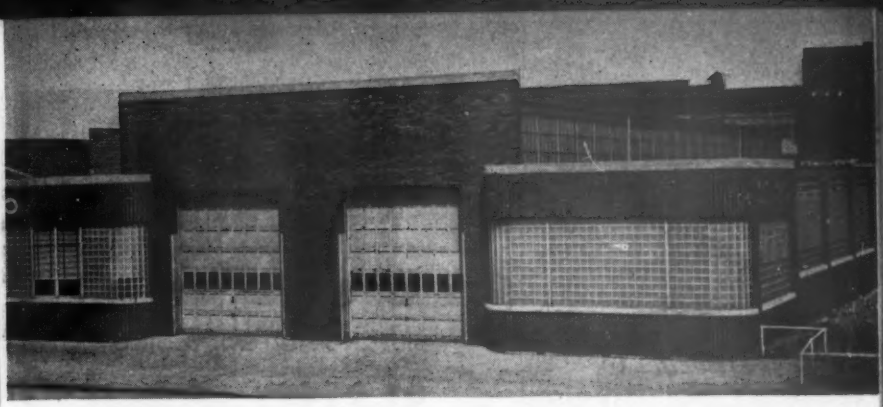

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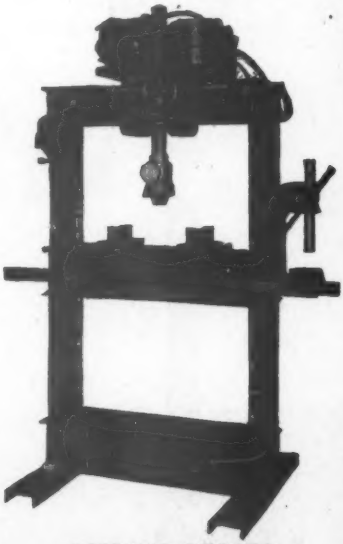

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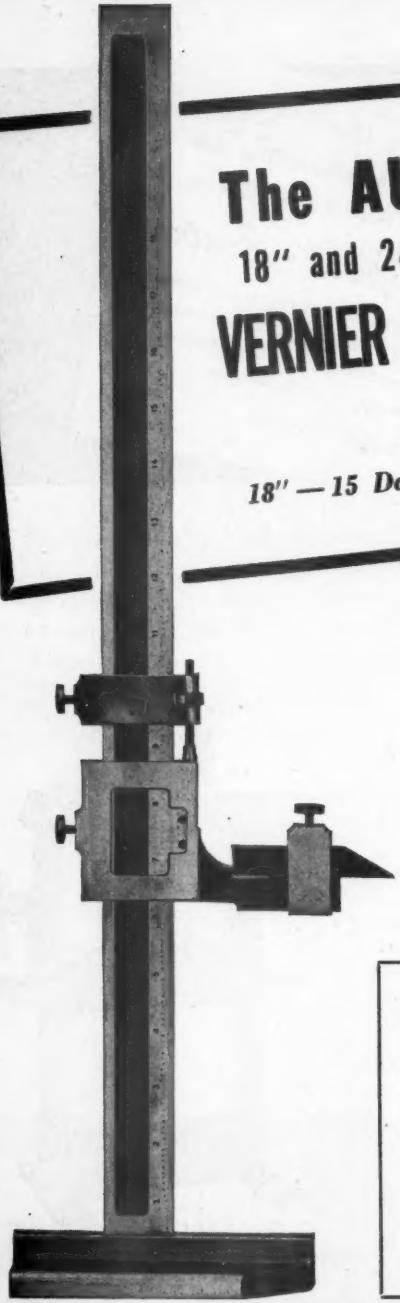

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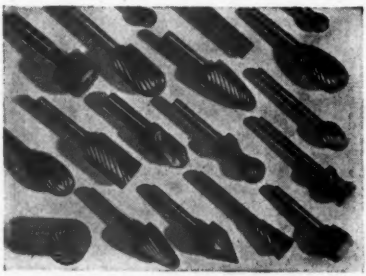

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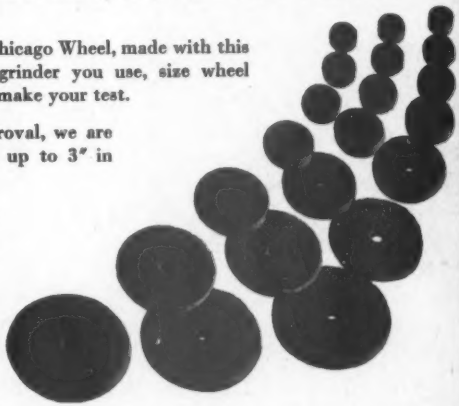

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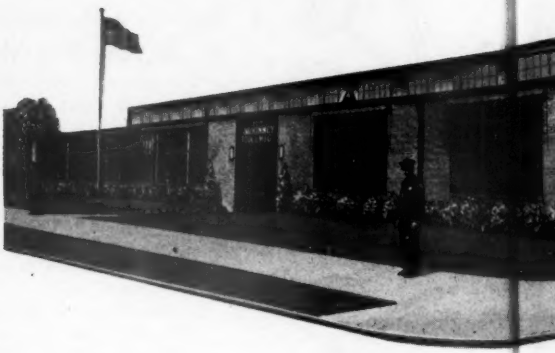

If there exists in your mind "a shadow of doubt" regarding McKinney's ability to deliver efficient tooling equipment—tools that will break those production bottlenecks and guarantee absolute accuracy of the finished product . . . then we invite you to take a trip through our modern tooling plant.

The age-old adage, "seeing is believing" was never more conclusively demonstrated than here at McKinney. Our services are second to none and we point with justifiable pride to this specially de-

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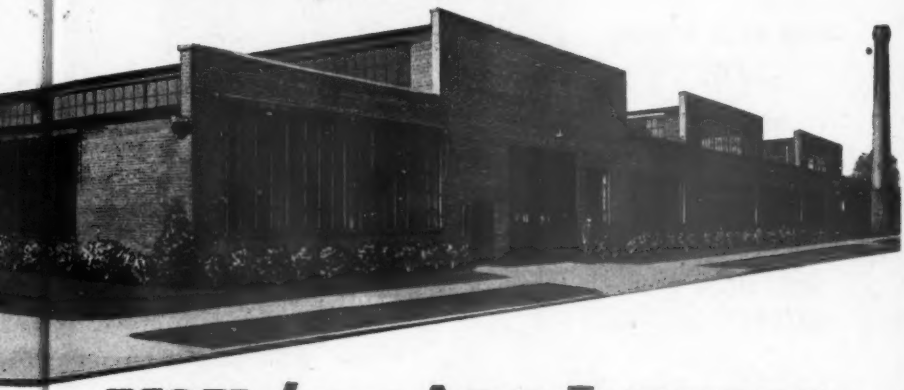

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Tool and Die Makers

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- Because of the extreme pressure which all of us were working under at that time, we didn't publicize the fact that such service was available. BUT . . . now we have set up facilities in our Tool and Die Department which will enable us to give you *prompt* advice without obligation, as to the fastest, cheapest way to do the job.
- If our Model D Rotary Head Miller is, in our judgment, the best bet for producing it — we'll tell you. In fact, we'll even make the job for you at a *very nominal cost* here in our own Tool and Die Department. What's more, we'd welcome having one of your men come to the plant to watch us make it.
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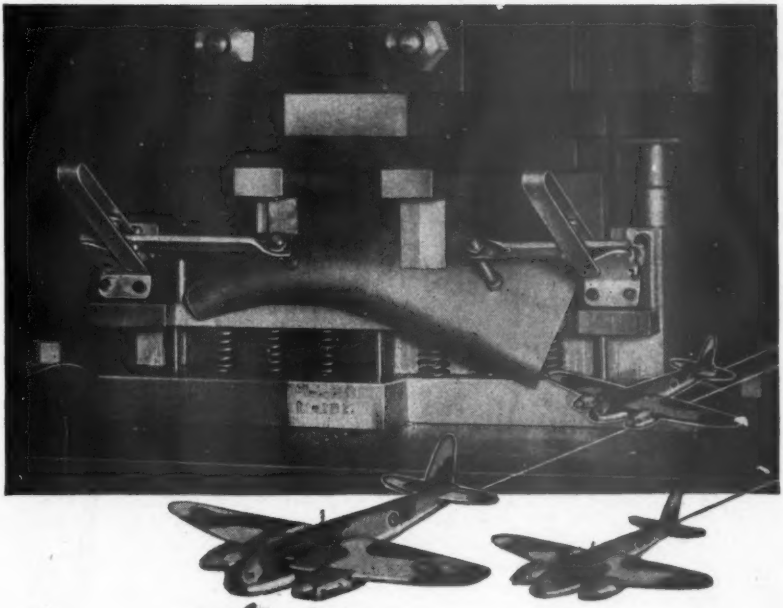

Target Berlin

Danly Die Set

Die Springs	Stripper Bolts
Dowel Pins	Goose Neck Clamps
Kwik Klamps	Knurled Cap Screws

Are all in this picture, Target Berlin!

The famous British "Mosquito" bomber, that keeps Berlin awake on "quiet" nights, carries many parts made in Danly Die Sets.

Shown above is one of 8 dies that form and trim the exhaust pipes of this World's Fastest Bomber. Also shown is an interesting example of Danly Die Makers' Supplies, assembled with the die in a Danly Die Set. Easy for the die maker, tough on the Axis.

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Originators of Chromium Plated Gage Blocks

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. . . or if you final-finish with

this **or this**

or this **. . .**

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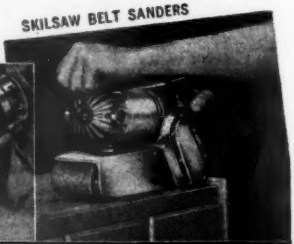
SKILSAW HAND GRINDER

SKILSAW BELT SANDERS



SKILSAW PORTABLE ELECTRIC TOOLS

MAKE AMERICA'S HANDS MORE PRODUCTIVE

LATROBE

RED ARROW 101 *for* METAL CUTTING TOOLS

BORING *and* FACING

MILLING

What users say! *

SUPERIORITY
"Grooving brass shells at 860 S.F.M. We get 10,000 to 11,000 pieces per grind compared with 6,600 pieces per grind with former tools."

LONGER TOOL LIFE
"Your Red Arrow 101 has been running 40 hours between grinds at 400 S.F.M. on grey iron. Our operators like it better because cutting edges do not break down and that means more production faster."

TOUGHNESS
"We are machining steel rings which are welded and steel castings with intermittent cuts. We plan to use Red Arrow 101 on all our tough jobs."

LESS TOOL GRINDING
"We find Red Arrow 101 very satisfactory. It runs double the production of other tools we have used on our boring jobs."

HIGHER SPEEDS
"Red Arrow 101 tool bits enable us to increase the surface speed 100% with four times the tool life."

** Selected at random from field reports.*

Latrobe RED ARROW 101—the Cobalt-Chromium-Tungsten alloy that can be cast into many types of metal cutting tools— is furnished in the "as cast" state ready for grinding to finished tool dimensions. Improved casting technique enables us to produce castings of such uniform structure that "notching" of the gate end of Tool Bits is unnecessary. Standard Tool Bits are carried in warehouse stocks.

Latrobe RED ARROW 101 requires no heat treatment; is easily brazed to tool shank or body; will operate at greatly increased speeds and effect valuable savings in production time.

Ask our service department to help you with any problem concerning the use of Latrobe RED ARROW 101—either applications, speeds, grinding, brazing or any other detail.

Write for this Bulletin

Latrobe ELECTRIC STEEL COMPANY

MAIN OFFICES *and* PLANT -- LATROBE - PENNSYLVANIA

STEP UP PRODUCTION

with

Continuous Cutting

the **WELLS WAY**

An all-purpose metal-cutting saw, the Wells No. 8, can be used on production, in stores, toolrooms or on maintenance for dependable service in the cutting of metals.

Three-speed selection provides the most efficient cutting speed operation. Gravity controlled feed and automatic shut-off permit one person to keep 2 or more Wells Band Saws in operation.

For low first cost, installation cost and power cost . . . for a long service life with a minimum of maintenance use a Wells No. 8.

See your distributor or write direct for complete details

Specifications
WELLS No. 8

CAPACITY: Rectangular . 8" x 16"
(Special Guides) . . . 5" x 24"
ROUNDS: . . . . 8" diameter
MOTOR: . 1/2 H.P. current optional
SPEEDS: Selective 60, 90, 130 ft. per. min.
WEIGHT: . Approximately 750 pounds

Wells SAWS

Wells

Products by Wells are Practical

METAL CUTTING BAND SAWS

WELLS MANUFACTURING CORPORATION
1940 ASH STREET, THREE RIVERS, MICH.

Tool room precision finishes with a production grinder . . . surfaces ground to such close tolerances that you can measure them in micro inches . . . that's what the DoALL offers.

You'll like its quiet, vibrasionless performance, its ease of operation. Designed so operator can sit and watch the work at close range without eyestrain or physical discomfort.

And . . . here's the interesting, modern auxiliary equipment available for use with the DoALL:

MAGNETIC CHUCK. Holds work firmly in place with variable amount of magnetic force.

SELECTRON. Controls chuck power, demagnetizes chuck, rectifies current, etc.

COOLANT UNIT. Steady flow of 1 to 30 gallons per minute.

DUST COLLECTOR. Keeps work and table free from dust.

GRINDING WHEELS. Perfectly balanced. Various abrasives and grains. Sizes 7 and 10" diameters.

It will Pay you to Investigate the DoALL now.

DoALL INDUSTRY'S NEW SET OF TOOLS

CONTINENTAL MACHINES, INC.
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Sales & Service Offices: Baltimore, Boston, Chicago, Cleveland, Denver, Detroit, Erie, Houston, Indianapolis, Los Angeles, Milwaukee, Minneapolis, New Orleans, New York, Orlando, Philadelphia, Pittsburgh, Rochester, Rockford, St. Louis, San Francisco, Seattle, Toledo, Tulsa, West Hartford

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STANDARD TOOL BITS • STANDARD TIPPED TOOLS • SPECIAL TOOLS-TIPPED AND SOLID • CASTINGS

Crucible Steel Co. of America
405 Lexington Ave., N. Y. 17, N. Y.

☐ Please mail me your new 28-page book, *"REXALLOY CUTTING TOOLS"*.

☐ We would like to discuss the possible use of REXALLOY in our plant.

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HANDLE WITH CARE!

Hardened tools are tough—but cutting edges are brittle. Hammering them onto arbors or into tool holders can be as harmful as dropping them on machine tables or concrete floors. Until the last shot is fired, tools are weapons. Treat 'em right!

NATIONAL

TWIST DRILL AND TOOL COMPANY

DETROIT AND ROCHESTER, MICHIGAN

National cutting tools, sold by leading Mill Supply Distributors, are tools of character.

★ *—a modern development for trans*

ERICKSON *Precision*

COLLET CHUCKS

Model "01" accurate within .0005 or less at the nose. ★ **Model "02" accurate within .001 or less at the nose.**

The Erickson Precision Collet Chuck is outstanding for its super gripping strength and ability to maintain accuracy.

Erickson Engineers regularly solve problems for many types of manufacturers anxious to improve results and profit by savings through proper handling of work.

Uses and applications of the chuck to fit your requirements will gladly be recommended upon request.

U. S. Patents No. 2,228,685. Other patents pending.

The ERICKSON COLLET

OPEN SLOTTED BOTH ENDS

COLLAPSES 1/32" MAINTAINS GRIPPING STRENGTH and ACCURACY

High speeds and heavy feeds may be used, as the 8 point grip and extreme accuracy of concentricity avoid vibration and loosening.

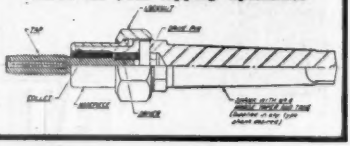
One Erickson Collet Replaces, at least, 7 Single Purpose Collets

The ERICKSON EXPANDING MANDREL

Uses an inverted adaptation of The Erickson Collet. Inquiries solicited for your requirements.

The ERICKSON TAPPING CHUCK

An outstanding new development. Send for information covering this chuck for your tapping operations



ERICKSON CHUCKS ARE STANDARD EQUIPMENT ON MANY MODERN MACHINES

Leading manufacturers of newer equipment have been quick to recognize in the Erickson Chuck, a gripping means that adds to the accuracy and precision of their products. Inquire about Erickson Chucks for standard equipment.

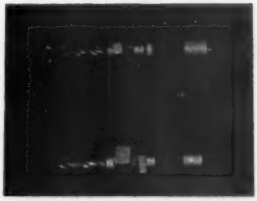
ERICKSON STEEL CO. Dept. A

mitting precision and accuracy ★ ★
from the machine to the job

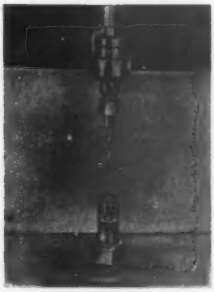
Model 201 High Speed Router Chuck with extended nose piece for pattern following.

Main and auxiliary turrets equipped with Erickson Chucks. Note short drill overhang, taps and reamers.

Model 102 Chuck—adapted for standard floating holder operations.



Models 102 and 402 Chucks in use on Automatic Screw Machine.

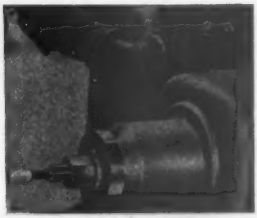


Model 301 Chuck adapted to quick change production operation on upper spindle. Note self-contained, interchangeable drill bushings in special nose piece on lower chuck.

Vertical Milling operation with 101 Chuck.

Horizontal Miller with 102 Chuck used to hold Woodruff Key Cutter.

SEND FOR COPY OF BULLETIN "E"



Model 301 Chuck designed for high speed internal grinding operations.

Model 201 used in drill press. Extra long drills can be used, by extending them from the chuck as they wear.

2309 Hamilton Ave., CLEVELAND 14, OHIO, U. S. A.

All the facilities of the N. A. Woodworth Company are devoted to one purpose . . . The manufacture of precision tools and gages with the longest accurate life . . . To give users the lowest possible operating costs.

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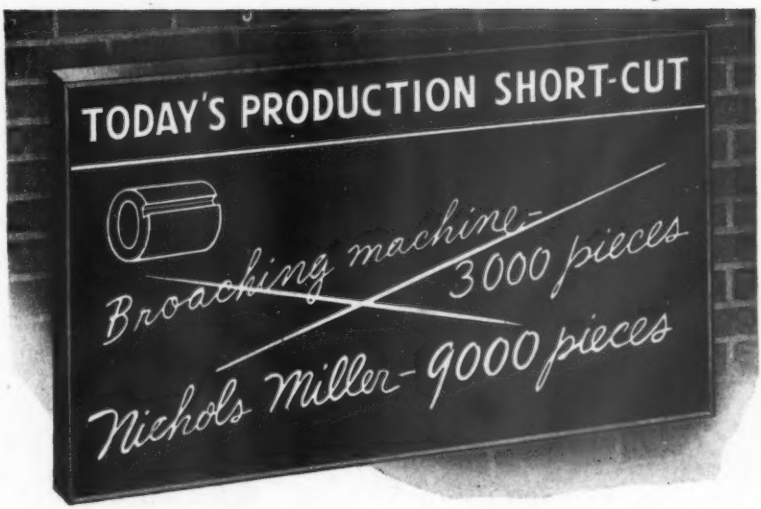

MILLING a wrench slot in these rings was originally treated as a broaching operation until the job was put on a Nichols Miller and the output was increased from 3,000 pieces to 9,000 every twenty-four hours.

This is not an unusual situation for the Nichols Miller, for this is not an ordinary hand miller. Starting with the principle of bringing the cutter on a sliding head down to the work, W. H. Nichols & Sons has engineered around it a machine tool that permits countless high-speed machining operations heretofore considered only within the scope of heavier and costlier machine tools.

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Whether yours is a large plant or a small shop, you will be interested in the "low-cost-per-piece-milled" advantages of the Nichols Miller. Write for 86-page handbook.

MFD. BY W. H. NICHOLS & SONS, WALTHAM, MASS.

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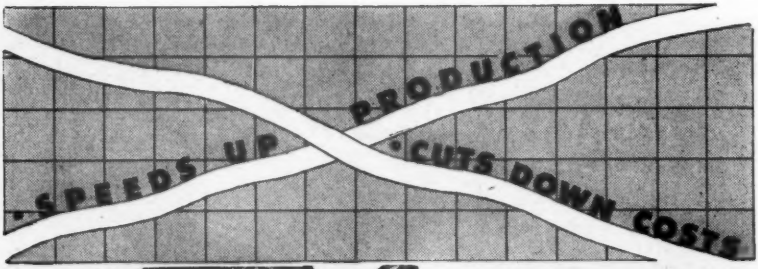

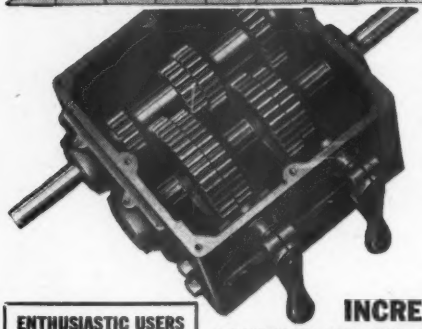

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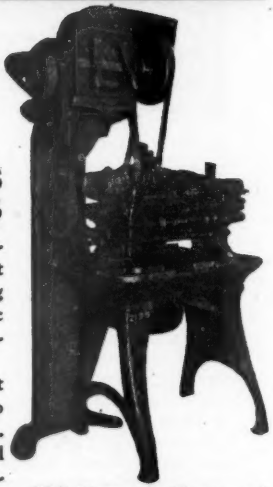
UNI-DRIVE
Motorizes Machine Tools



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Many of the famous companies listed at the left report production increases ranging from 25% to 300% and drastic reductions in costs after installing Turner Uni-Drives.

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FOR Brown & Sharpe and Cleveland Automatic Screw Machines; Lathes, Shapers, Milling Machines, Turret Lathes, Radial Drills, Boring Mills, Hobbing Machines.

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List $45.00

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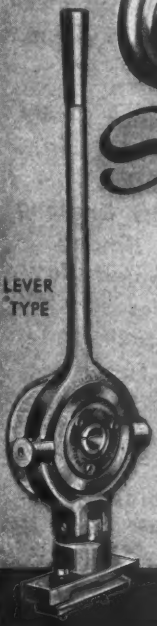

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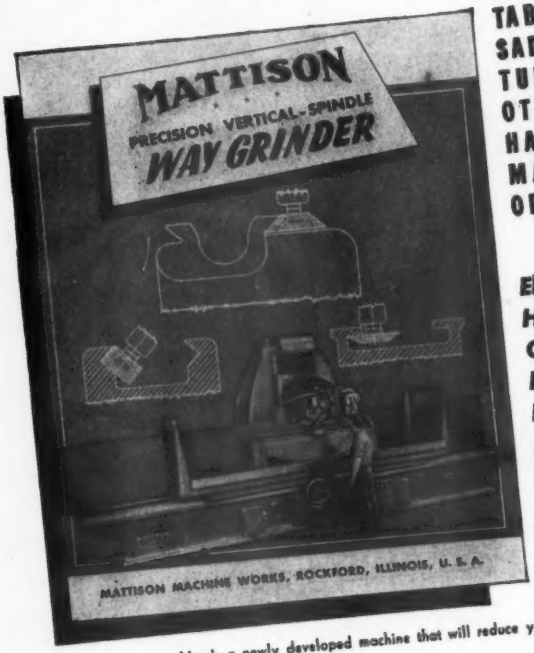
- Increases ½" collet capacity lathes to ¾".
- Ready for instant use and interchangeable on any 1½" x 8 thread spindle lathe . . . Atlas, Logan, 9" South Bend, Clausing, etc.
- Full Spindle Accuracy.
- LEVER TYPE for continuous production. Feather pressure releases work while lathe is running. LIST $79.50, Collet extra.
- HAND TYPE for use where quantity production is not required. Lathe must be stopped to open and close collet. LIST $19.75, Collet extra.

GENERAL DIE-STAMPING-TOOL COMPANY
PRECISION COLLET DIVISION 265 Canal Street, New York 13, N.Y.

A NEW MATTISON GRINDER

for Finishing



TABLES—SLIDES—SADDLES—HEADS—TURRETS AND OTHER PARTS HAVING ANGULAR MACHINED WAYS OR SURFACES—

Eliminates Costly Hand Scraping Operation . . . Permits Grinding Parts Having Hardened Ways to Closest Accuracy and Fine Finish . . .

Here's a newly developed machine that will reduce your finishing cost and provide precision results.

LET US SEND YOU THIS NEW FREE CIRCULAR containing complete information.

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Get uniform radius on every tooth *this easy way*

TO MAKE every tooth on carbide milling cutters and reamers carry an equal share of the load, each tip must be ground to uniform radius—a job that's easy to do with DI-MET Diamond Wheels. Here's why: DI-MET'S ability to hold wheel size eliminates the need for individually checking each tooth during grinding operations. All teeth are automatically brought to uniform size on the last pass without individually indicating each and without constant machine adjustment, because wheel wear between consecutive passes is undetectable.

Extremely slow rate of wear is only one of the many DI-MET Diamond Wheel advantages for grinding carbides. In addition, high accuracy is obtainable from end to end on carbide cylindrical and surface grinding jobs. DI-MET wheels cut many times faster than vitrified wheels—produce smoother surfaces and much keener edges, which lengthen tool life. Rim speeds are practically constant throughout long wheel life.

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MANUFACTURERS OF DIAMOND ABRASIVE WHEELS

First cost should be no consideration when considering the use of tungsten carbide dies. They not only outlast steel dies many times, but they stay sharp longer between grinds—they give a better finish on the surface and edges of the parts produced—accuracy is built in *to stay*—they are cheaper in the long runs.

Tungsten carbide dies, made by New England, will give maximum satisfaction. You can be sure they will be made exactly as specified, *plus* that New England extra—*mirror finish*. Why not send us your drawings (plus complete information) for an estimate—there is no obligation.

FORMING
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NEW ENGLAND CARBIDE TOOL CO.
INCORPORATED
60 Brookline St., Cambridge 39, Massachusetts

METALITE CLOTH
SLOTTED DISCS

3/8 to 6 inch diameters

Speed War Jobs

AT LEFT: This stainless steel Fuel Line was previously hand-scraped and hand-sanded. Now, one spindle equipped with 3/4" slotted Disc, grit #100, does the inside edge. And, equipped with a cup adaptor, also does the outside edge using 1 1/8" Slotted Disc, grit #120. Production is up 350%.

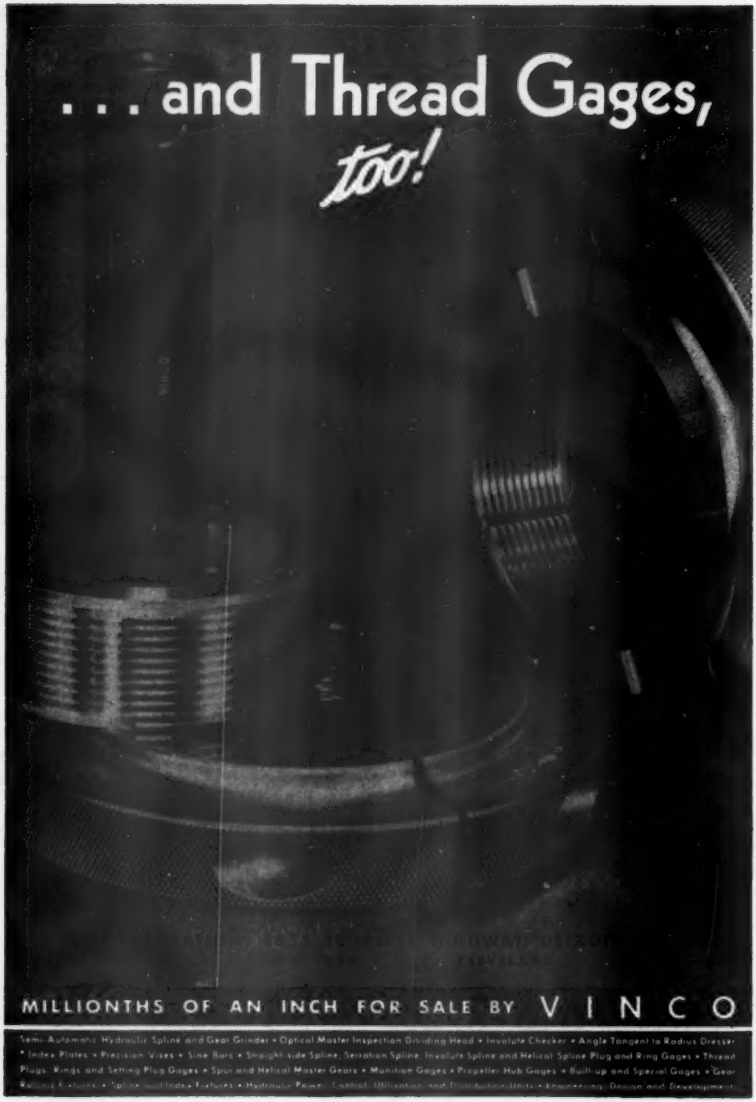
AT RIGHT: This 2-Bore Aluminum Throttle Body has a finished bore. There was slippage with hand scrapers. Two 1 1/2" unslotted Metalite discs, grit #60, back to back, were used. This method proved twice as fast as the former hand scraping.

BELOW: In this illustration 5" Slotted Discs, grit #100, are used to put 1/16" radius on the edges of these Magnesium 3-Bore Throttle Bodies. This saved tooling and additional machines. Time, 3 bores, .68 of a minute.

These SLOTTED DISCS, in almost endless sizes and grits, are but one of many Metalite Cloth "Gadgets" ready for instant use on power tools. We'll gladly help you select the proper "Gadgets" for improving a wide variety of your own sanding and finishing operations. Write us.

BEHR-MANNING · TROY, N.Y.

(DIVISION OF NORTON COMPANY)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too!
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Semi-Automatic Hydraulic Spline and Gear Grinder • Optical Master Inspection Dividing Head • Involute Checker • Angle Tangent to Radius Dresser
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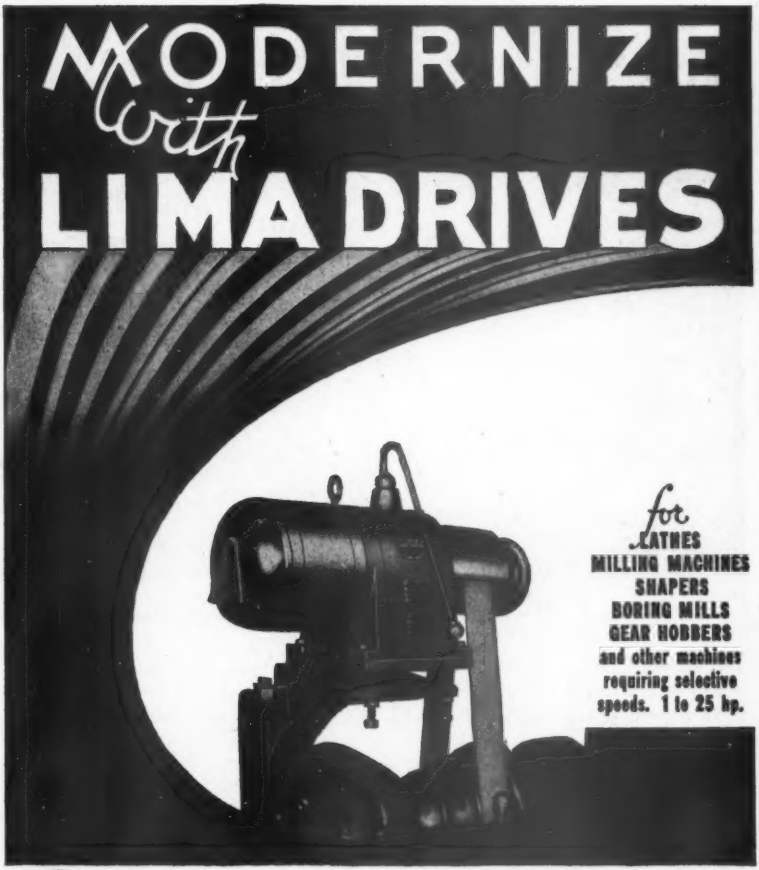

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MILLING MACHINES
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and other machines requiring selective speeds. 1 to 25 hp.

Large enough to successfully serve you, yet small enough to give personal attention to your needs.

THE LIMA ELECTRIC MOTOR CO.
884 FINDLAY ROAD
LIMA, OHIO
REPRESENTATION IN MOST PRINCIPAL CITIES
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Masonite Die Stock used in a stretch press to form aluminum strips at Fairchild Aircraft, Division of Fairchild Engine & Airplane Corporation.

MASONITE Die Stock is being used more and more for forms on stretching machines.

This is one of the ways in which this modern die stock is being employed by manufacturers throughout the country. It's a great time and money saver when used for special types of mating dies, forming blocks, templates, jigs and fixtures.

Remember, while Masonite Die Stock is only one-sixth the weight of steel, it has great compressive and flexural strength. It can be fabricated in pattern or metal shops with great speed, and it stands up under present-day production requirements.

Masonite Die Stock is available in thicknesses of ¼ to 2 inches . . . in sizes of 48 x 72 inches and 48 x 144 inches. If you want to know more about this amazing semi-plastic material, which is so easy to handle and will not shrink, check or twist, please mail the coupon.

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Awarded to Masonite Corp. plant at Laurel, Miss.

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No. 1½ HAND FEED SURFACE GRINDER

PROMPT DELIVERY

Hand Feed . . . ideal for short-run precision jobs. Motor integral with wheel head — no belts, sprockets or chains. Large hand wheels, conveniently located, permit continuous operation with minimum fatigue. Unusual capacity: 15" long x 10" wide x 12" high. ABRASIVE design and precision workmanship recommend the No. 1½ for the finest type of flat, form and gage grinding.

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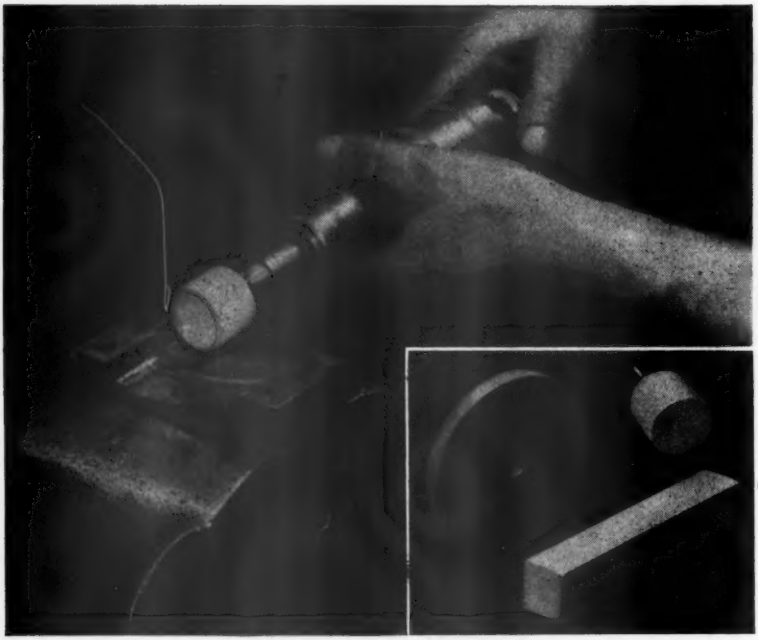

Now a complete line "MX" WHEELS, MOUNTED WHEELS AND STICKS

On many jobs which call for finishing and polishing there are many out-of-the-way-places—grooves, curves, angles and flat surfaces not readily accessible. To reach such places the "MX" Mounted Wheels are proving to be the solution of this sometimes vexing problem.

"MX" Wheels, both straight and mounted, are being used on such typical jobs as polishing out tool marks and scratches, cleaning out the channels of connecting rods. For finishing flutes of broaches and reamers. For breaking down corners on miscellaneous parts.

NOTE: "MX" *Mounted* Wheels are made only in the straight shapes but they can be readily shaped or formed by using a fine grit Carborundum Brand Silicon Carbide Stick as a dressing tool.

"MX" Sticks are particularly useful for breaking down edges and finishing work that can be turned in a lathe.

Send for "MX" Booklet. The Carborundum Company, Niagara Falls, New York.

"MX" Products by CARBORUNDUM

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SHEFFIELD DIAL INDICATOR *SNAP GAGE*

FOR INSPECTION AND CLASSIFICATION

1 Gage may be used with dial either at the bottom or the top, whichever is more convenient.

2 Dial is adjustable radially and can be swung through 360° to facilitate reading.

3 Scale has a range of .005"—each graduation .0001".

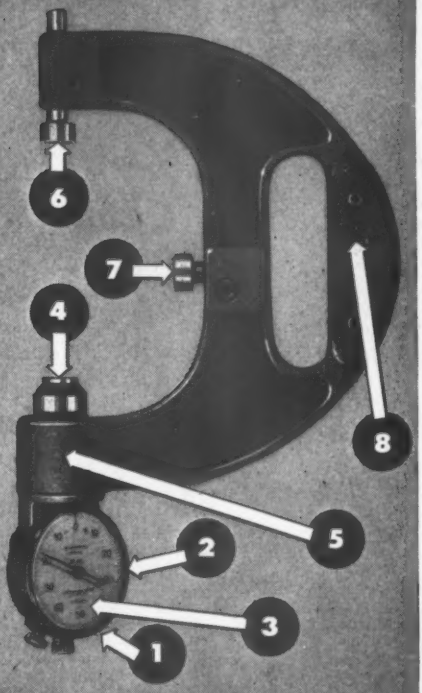
4 Movable anvil is spring urged for constant gaging pressure, but spring has no effect on indicator. Special spring pressures available.

5 Movable anvil bearing is long enough to preserve alignment with the fixed anvil.

6 Fixed anvil is adjustable to a maximum of one inch.

7 Adjustable backstop has a cylindrical face for accurate line contact.

8 Comfortable handle with plastic grip to insulate gage from heat of inspector's hand.



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THE SHEFFIELD CORPORATION

Dayton 1, Ohio, U.S.A.

MACHINE TOOLS — GAGES — MEASURING INSTRUMENTS — CONTRACT SERVICES

STOP DUST WITH DUSTKOPS

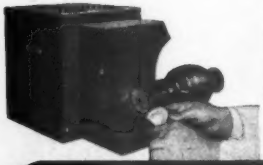
CUT-IN DUSTKOPS DURING A "CUT-BACK"

When only a few grinders are in operation, shut down the centralized dust collecting system and save enough power costs to pay for the Dustkops.

Dustkops are unit type dust collectors —highly portable, easily installed (usually without tools), quickly obtained —will solve the "interim dust collecting problem" during a change-over.

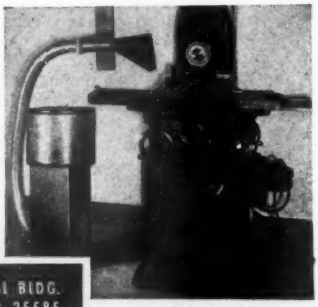
The bigger your plant, the quicker Dustkops will pay for themselves.

Don't remove the main duct; install a DUSTKOP *around-the-corner*. The compact Dustkop can be moved when the grinder is shut down.



Laboratory Model PS-1 DUSTKOP will stop dust, lint, and filings. A removable tray is for sludge from wet grinding.

Here's how to support the flexible metal hose that connects the wheelhood to Model 950 Dustkop for a Surface Grinder.



AGET-DETROIT CO.
617 FIRST NATIONAL BLDG.
PHONE: ANN ARBOR 25585
ANN ARBOR, MICHIGAN

Detroit Phone
CAdillac 3090

WHEN THE ALL CLEAR SOUNDS FOR ALL

Save Months

IN RECONVERSION

WITH

Walker-Turner MACHINE TOOLS

(Radial Drill)
Typical example of Walker-Turner versatility is this Radial Drill. Drills to the center of a 62" circle. Spindle speed range, 180 to 8200 R.P.M. Head tilts 45° in either direction.

These streamlined units deserve a place in your reconversion — because they're flexible, rugged, simple, safe, easy to operate, and offer a wide range of speeds for cutting practically any material. On the "costs" side, Walker-Turner Machine Tools show marked savings in power consumption, capital investment and operating expenditures. And fast delivery . . . to help you avoid reconversion delays . . . will be another Walker-Turner feature.

WALKER-TURNER COMPANY, Inc., Plainfield, N. J.

(20" Drill Press)
Automatic power feed is a feature of the newest Walker-Turner 20" Drill Press.

(Metal Cut-off Machine)
"Kick" cutting with a Walker-Turner Radial Cut-off machine.

(Band Saw)
Cutting a special profile in plastics with a Walker-Turner Band Saw.

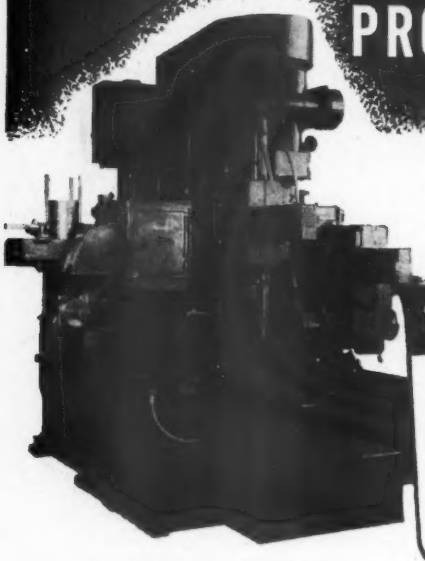
108

walker-Turner COMPANY, Inc. PLAINFIELD, N.J. U.S.A.

MACHINE TOOLS

DRILL PRESSES — HAND AND POWER FEED • RADIAL DRILLS
METAL-CUTTING BAND SAWS • POLISHING LATHES • FLEXIBLE SHAFT MACHINES
RADIAL CUT-OFF MACHINES FOR METAL • MOTORS • BELT & DISC SURFACERS

BESLY GRINDERS PRODUCTION!



THE PROBLEM ••

To speed the accurate grinding of parallel surfaces on small parts such as thrust washers, oil seals, sides of bearing races, piston rings, etc.

THE SOLUTION ••

Besly No. 926 Grinder

The 926 Besly Vertical Double Spindle Grinder is used as the finish grinder for parts that have been previously rough ground on standard double spindle grinders.

Send for this Booklet on Besly Titan Steelbac Discs — uniform, easy to mount, they speed output.

Charles H. Besly and Company was awarded the Army-Navy "E" on December 1, 1943. More than 1/3 of the holders of the coveted "E" are Besly customers.

RESULTS •• 6 1/8" x 3/32" aircraft engine piston rings were finished to within .0002" for size and parallelism. Light test for flatness, perfect — at rate of 140 passes per minute. Six to eight Micro Inch Finish produced with help of Grain No. 120 Besly Titan Abrasive Members.

BESLY

BESLY GRINDERS AND ACCESSORIES
BESLY TAPS • BESLY TITAN ABRASIVE WHEELS

CHARLES H. BESLY AND COMPANY, 118 N. Clinton St., Chicago 6, Ill. Factory: Beloit, Wis.

$155 PRICE REDUCTION

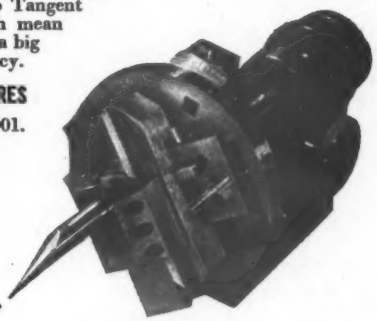
NOW $495.00 LESS DIAMONDS

FORMERLY PRICED AT $650

Take advantage of this substantial price reduction and place your order today for immediate delivery. The now famous PERFEX Angle to Tangent Radius Dresser has advantages which mean real savings in time and money, and a big step forward in accuracy and efficiency.

CHECK THESE OUTSTANDING FEATURES

1. Sets radius accurately to within .0001.
2. Returns diamond to center after dressing an angle within .00005.
3. Dresses a smaller than .050 radius to a full half circle without additional attachments.
4. Diamond automatically locates on center.
5. Perfect blend between radius and angle of tangency.



PERFEX Angle to Tangent

RADIUS DRESSER

Immediate delivery

ALL ORDERS SHIPPED THE SAME DAY RECEIVED

PERFEX DRESSER CORPORATION

3607 GAYLORD . DETROIT, MICHIGAN

By the Army, the Marines, and the Navy, too.

SHELDON Precision Lathes have been selected by the Army for its Mobile Machine-Shop Units, by the Marine Corps for its trailerized shops and by the Navy as the ideal lathes for several types of repair shops aboard ship and ashore.

SHELDON Lathes are also widely used in British, Canadian, South African, Russian and other allied factories to speed the production and maintenance of war material . . . proof of worldwide SHELDON accuracy and dependability.

SHELDON 10" (1-inch collet capacity) Precision Lathe and Bench Unit with E-type underneath motor drive.

SHELDON

SHELDON MACHINE CO., INC.

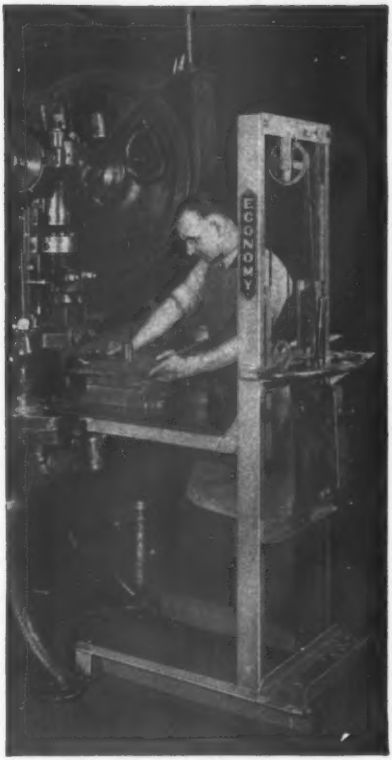
4236 N. Knox Ave. Chicago 41, U. S. A.

SAVE PRODUCTION TIME

with a

SHOPLIFTER

One man can handle heavy dies alone. Not necessary to stop other machines to get help.



MORE production per day from your machines if a Shoplifter is handy to do the heavy job of moving dies from storage racks to the press. In these times when maximum production of machines is of vital importance, much time and labor can be saved if the operator can handle the heavy work of changing dies without calling for help from other operators.

The Shoplifter is built for this job. Dependable and safe with a rated capacity of 500 lbs. (heavier machines up to 5000 lbs. can be furnished). Entire machine built of structural steel. Electrically welded throughout. Platform lifts 54" above floor and lowers to within 5½" of floor. Overall height 72". Size of platform 24"x24" wood deck. Crank, up and down, hoist unit.

ECONOMY ENGINEERING CO.
2659 W. Van Buren St., Chicago, Ill.

Price **$147.50**

IMMEDIATE DELIVERY

YOU COULDN'T ASK FOR ANYTHING MORE SIMPLE — OR BETTER THAN

WHISTLER ADJUSTABLE PUNCH and DIE UNITS

Whistler Adjustable Dies work on any type press and because of their simplicity even new workers quickly learn to make pattern change-overs—increasing productive press hours. Absolute precision on short or long runs. Whistler design permits more perforations in a given area—often reducing press operations.

For quick and complete information on the advantages of Whistler Adjustable perforating and notching dies send a description or drawing of your work.

These pieces produced with Whistler Adjustable Dies clearly illustrate the re-use of same punch and die units.

These photographs show the simplicity of a Whistler Adjustable Punch and Die assembly. Every piece is interchangeable.

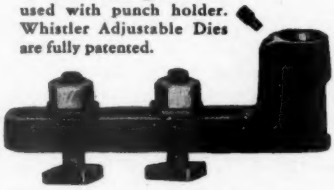
Self-locking bolts on punch holder drop into T slots of die shoe. Set-screw engages into recess at base of punch. Punch cannot turn or pull out in operation.

Punches of finest tool steel are machined to .0001" tolerances.

Stripper unit fits smoothly over punch—no "wobble". Flushed set-screw engages into groove on punch body. Stripper or punch quickly removed when desired.

Grooved heads on dies make lifting from holder quick and easy. Like the punches, dies are held firmly into holder by set-screw in recess at base. Whistler *precision* is known the world over.

Die holder has self-cleaning slug chute. Special design bolt heads present two bearing surfaces to T slot channel—self-locking, same as used with punch holder. Whistler Adjustable Dies are fully patented.

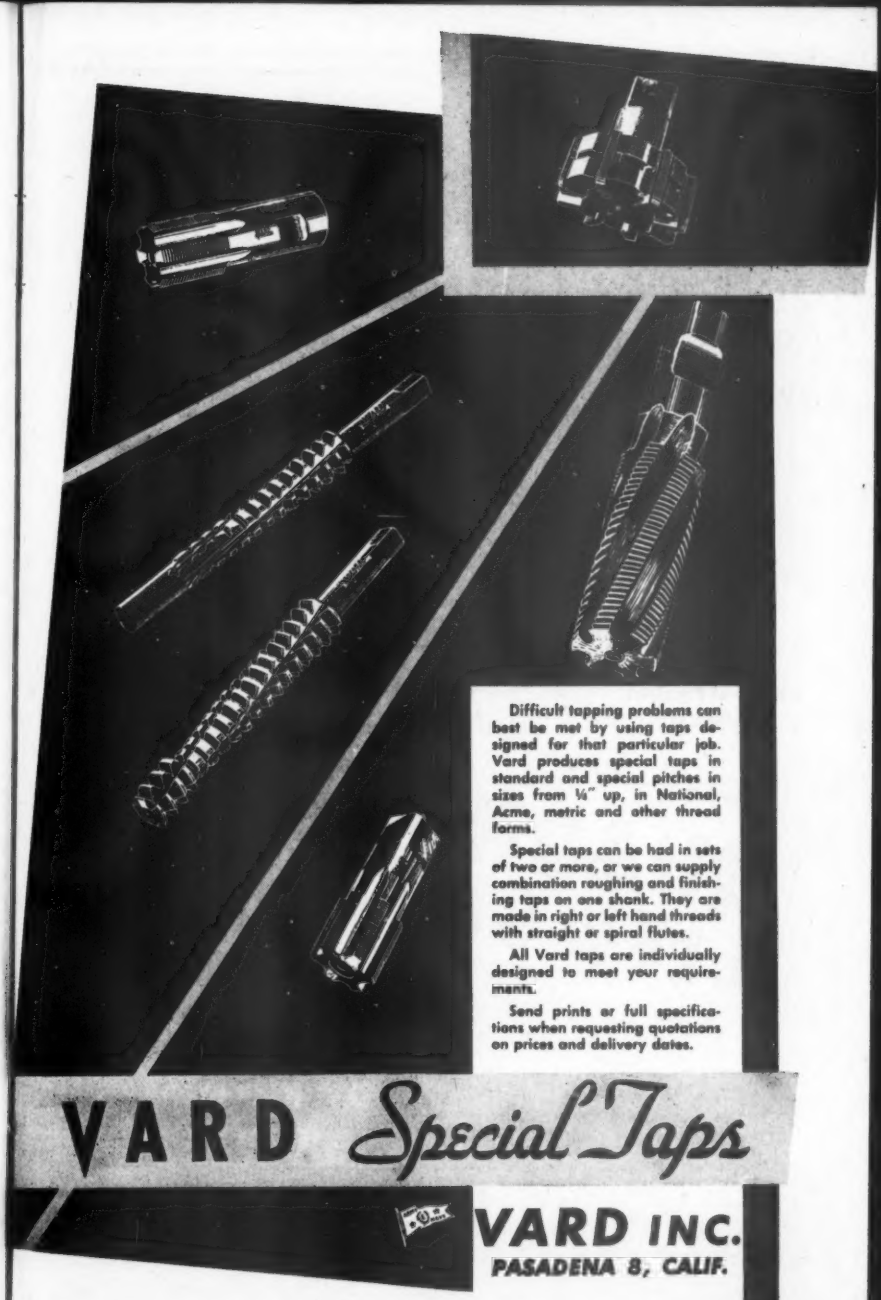


Write for the Whistler Catalog—every Production Executive should have it.

S. B. WHISTLER & SONS, Inc.

Over 25 Years of Tool and Die Making Experience

752-756 MILITARY ROAD BUFFALO, N. Y.



Difficult tapping problems can best be met by using taps designed for that particular job. Vard produces special taps in standard and special pitches in sizes from ¼" up, in National, Acme, metric and other thread forms.

Special taps can be had in sets of two or more, or we can supply combination roughing and finishing taps on one shank. They are made in right or left hand threads with straight or spiral flutes.

All Vard taps are individually designed to meet your requirements.

Send prints or full specifications when requesting quotations on prices and delivery dates.

VARD *Special Taps*

VARD INC.
PASADENA 8, CALIF.

PROVEN TODAY - - - FOR TOMORROW'S PRODUCTION

4 Rows of Precision Ball Bearings

QUADRO *Precision* LIVE CENTERS..

QUADRO Precision LIVE CENTERS will outlast old-fashioned solid centers to pay for themselves quickly. They combine the rigidity of the solid lathe center with the frictionless properties of the ball-bearing to form a tool which will increase production without sacrificing accuracy. Manufactured in all tapers and sizes.

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DAKON

TOOL AND MACHINE CO., INC.

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15 Top Quality Standard Screw Products available from one reliable source

Buy your requirements of any or all of the 15 items illustrated above from a distributor of products made by The Chicago Screw Company. It will mark the end of quality problems and the beginning of speedy, trouble-free assemblies.

Every item in this popular line is of excellent quality, in keeping with the fine reputation our company has gained through 72 years experience in the manufacture of threaded products.

ARMY E NAVY

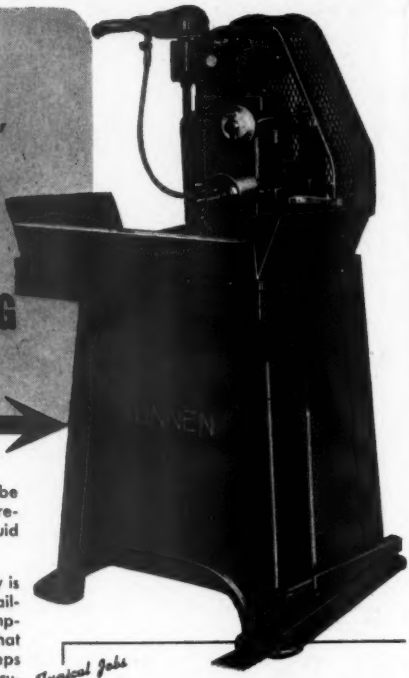
These Fine Products are sold only thru Authorized Distributors

THE CHICAGO SCREW CO.

ESTABLISHED 1872

1026 SO. HOMAN AVENUE CHICAGO, ILL.

A New Base With a Coolant Pump Improves the Accuracy, Speed, and Finish of Jobs Honed on the SUNNEN PRECISION HONING MACHINE



Many internal honing and finishing jobs can be more efficiently handled on the Sunnen Precision Honing Machine with a stream of honing fluid flowing over the work.

For that reason, a new base and pump assembly is furnished with the machine. The new base is also available to present owners of the honing unit. The pumping unit provides a constant flow of honing fluid that acts as a coolant, carries away cuttings, and keeps the abrasive stone in sharp cutting condition. Accuracy is greater, finish is better, and speed is increased.

Other refinements include a machine light for inspecting the finish and gaging of the finished parts.

On the Sunnen Precision Honing Machine, straight, round holes are produced within .0001" of absolute accuracy. Production jobs in hardened steel have been held to a tolerance of .000025". A super-smooth finish of from 2 to 3 micro-inches provides a better working surface so that parts last longer on the job.

The coveted Army-Navy "E" waves over the Sunnen plant—evidence of the important part Sunnen equipment is playing in the war effort.

Get complete information on how all these advantages can be put to work in your plant on your internal finishing jobs. A Sunnen engineer will be glad to call at your convenience — or write for free bulletin.

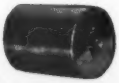
Typical Jobs

Compressor Yoke. Alignment maintained and better finish produced.

Automobile Distributor Shaft Gears. Taper removed at a rate of 80-90 per hour.

Carburetor Idler Pump. Smooth, straight-line finish in blind hole prevents piston leakage.

Carburetor Idler Valve Jet. Hole is honed after reaming for smooth action.



Header Die. Life of header dies increased 3 to 9 times over lapping. Knock out pin breakage practically eliminated.

Cast Iron Valve Stem Guide. ½ to one thousandth removed — 220 pieces per hour. Better finish and straighter hole.

SUNNEN

SUNNEN PRODUCTS COMPANY

7947 Manchester Avenue, St. Louis, Missouri

Canadian Factory: Chatham, Ontario

"ULTRA-FINISH"

puts new-precision faces on

GAGE BLOCKS!

*"ULTRA-FINISH"... developed by FONDA engineers... is the advanced new method of processing the gaging surfaces of FONDA gage blocks. It utilizes a special compound in the machine-lapping operation.

CHECK THESE "ULTRA-FINISH" ADVANTAGES

1. It produces a surface of amazing new smoothness.
2. It develops the size, flatness and parallelism of the gaging surfaces to new standards of fine-precision accuracy.
3. Together with FONDA'S other special processes for wear-resistance, it enables the gage blocks to *hold* their original high accuracy during long-extended periods of service.
4. It makes the use of oil or other film unnecessary in wringing—thus eliminating errors in fine-precision measurement.
5. It improves the wringing qualities.
6. It enables you to better control your precision standards ... to facilitate your work ... to cut rejects and refinishing to a new low minimum.

Prompt Deliveries

FONDA GAGE COMPANY

STAMFORD, CONNECTICUT

Agents in all principal cities throughout the World

Learn the whole "ULTRA-FINISH" story by writing for Bulletin C

FONDA *Gage Blocks*

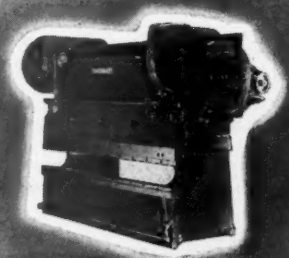
PASSED HIGHEST TESTS DEVISED BY THE NATIONAL BUREAU OF STANDARDS

27

Punching and Trimming a Giant "Mechano" Set...

With this giant version of "Little Willie's" Christmas toy, U. S. engineers restore devastated port handling facilities or create new ones with magic speed.

On this punching and trimming job holes must match up and edges must be true—Accuracy is a first consideration. The machine tool-like performance of Cincinnati Press Brakes does the job smoothly and economically.



For a complete picture of the wide uses of these brakes, write for Catalog B-2.

THE CINCINNATI SHAPER CO.

CINCINNATI OHIO U.S.A.

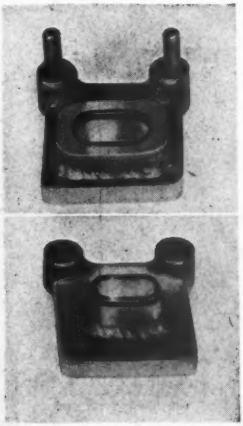
SHAPERS · SHEARS · BRAKES

Eureka TOOL STEEL ELECTRODES

save vital tool steel for Victory

Eureka TOOL STEEL ELECTRODES

save time in Reconversion to Postwar Products!



RIGHT NOW we are all devoting 100% of our time to the winning of the war, and the Welding Equipment & Supply Company's Eureka Tool Steel Electrodes are doing their part by saving tons of *vital* tool steel, and countless man-hours. This savings is accomplished in the many industries where Eureka Tool Steel Electrodes are being used in the repair and maintenance of Tool and Die sections and the composite construction of new dies by welding.

When *peace* again prevails, Eureka Electrodes will play an equally important part in industry by helping to speed up the reconversion for postwar manufacturing by saving valuable time in the composite fabrication of new dies.

Illustrations at left show fabrication dies with Eureka Tool Steel Electrode deposits used as cutting edges.

★ *If you are making postwar plans now, we invite you to write us for complete information on Eureka Electrodes today.* ★

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WELDING EQUIPMENT & SUPPLY CO.

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OUR JOB IS TO DO THE HARD THINGS
the Easy Way!
There's no substitute for experience and skill. That's why major plants throughout the country depend upon ELECTRIX for precision manufacture of difficult, important Gages and Tools. We'll tackle your problems, too, with care and speed. Write us!
GAGES • FORM TOOLS • SPECIAL TOOLS • MOLDS
FLUSH PIN GAGE
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PRECISION
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NO-GO
ELECTRIX
Corporation
Peacetime engineers of soft-rubber connectors for electrically-operated equipment, sold exclusively through U. S. RUBBER CO.
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DEVLIEG JIGMIL

No. 3-A
3" BAR

To more accurately and speedily serve the broad field needing a machine having

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THE SPACING ACCURACY OF A JIG BORER

• • •

THE PERFORMANCE QUALITIES OF A MILLING MACHINE

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THE CONVENIENCE AND FLEXIBILITY OF A HORIZONTAL BORING MILL

☆ A PRECISION MACHINE ☆

Featuring

NEW SPEED OF OPERATION

NEW ADVANCED FINGER TIP CONTROLS

NEW STANDARDS OF EXCELLENCE OF BORED HOLES

NEW ACCURACY IN MILLING

AUTOMATIC TABLE RETRACTION AND REPOSITIONING

Many machines in operation show 75% greater average daily productivity and improved dependability for precision.

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DEVLIEG MACHINE COMPANY
8100 FAIR AVENUE, FERNDALE (DETROIT), MICHIGAN

DEVLIEG MACHINE TOOLS

Tannewitz DI-SAWS

have LARGER CAPACITY, saw *Easier*, STRAIGHTER

In making inside and outside cuts on dies, tools, jigs, etc., as well as inside and outside filing and polishing, the modern die saw will save upwards of 70 per cent of the time required by ordinary methods and reduce costs proportionately. Don't overlook this great opportunity to step up both production and profits. But be sure to get the machine that gives you the added advantage of EXTRA CAPACITY (a full 24 inches between the blades) and the easier and straighter cutting that naturally follows from the use of larger wheels. Get the complete facts concerning the TANNEWITZ M-24, the most highly developed die saw on the market. Simply write for our DI-SAW Bulletin. Also describes larger DI-SAWS for special applications.

Other bulletins on request: Single and Variable Speed Foundry Band Saws, SHEET METAL CUTTING Band Saws.

THE TANNEWITZ WORKS, GRAND RAPIDS, MICHIGAN

Here's an outstanding time and money saving tool for your parts numbering operations—*the Mercury Interchangeable Type Holder.* It provides for fast, accurate and fully legible numbering of metal parts, eliminating errors, rejects and the time normally consumed in using single-character dies.

HERE'S ALL YOU DO:

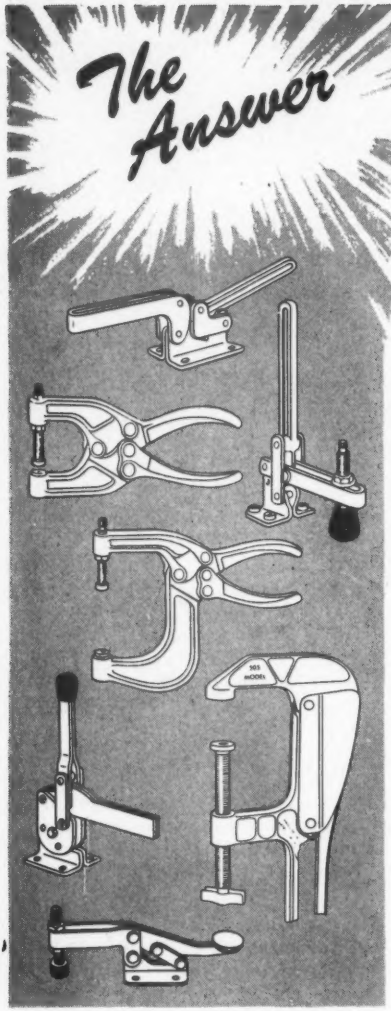
Unlike ordinary one-character dies, which must be used separately, the Mercury holds the entire part number—up to 16 digits, if needed. You simply "load" the tool with the correct part number and snap the cover shut. *Thereafter, as many duplicate parts as desired can be quickly and neatly stamped with just a single blow of the hammer for each part!* Time normally lost using a separate die for each separate digit is saved, and overlapping, wrong sequence and illegible numbering are eliminated.

The Mercury Type Holder has many more outstanding features you should know about. Type is quickly interchangeable for different part numbers . . . compactness aids in stamping smaller parts . . . all-steel machined construction insures long life, cuts replacement needs. Hardened and ground hand-cut steel type is available in a full range of sizes. Full details, including ordering data and specifications for both hand and press style holders, are contained in descriptive bulletin mailed free on request. Write for your copy today—ask for Mercury Bulletin 1-D

Immediate Delivery

MERCURY METAL DIE AND LETTER CO.

546 EAST 16TH STREET, LOS ANGELES 15, CALIFORNIA



The Answer

TO YOUR CLAMPING PROBLEM Is Here At

KNU-VISE

—where all our activities are devoted to the engineering and building of clamping devices exclusively.

Building clamps is our only business . . . the job we know how to do, and *do well!* Long experience in solving nearly all types of clamping problems has taught us how to make clamps to meet every conceivable clamping requirement.

With a KNU-VISE clamp, pressure with unyielding grip can be applied in an instant . . . and work can be released with the same speed. The key to this high efficiency is Toggle Action.

Illustrated are many standard KNU-VISE clamps, but KNU-VISE is equipped to develop also special clamping devices to your unusual needs. Feel free to call upon us for advice on your clamping job.

BUY WAR BONDS

KNU-VISE INCORPORATED

1330 PLUM STREET DETROIT 16, MICH.
4328 SAN FERNANDO RD. GLENDALE, CALIF.

NEW... Acro NEEDLE EYE LAPS For Small Diameters

Exclusive *Barrel-Shaped* "SLIT" Lap Prevents Bell-Mouthing of Small Holes

Small holes, straight or tapered, can now be more accurately finished with Acro Needle Eye Laps. These new, scientifically designed, tested and proven "slit" laps finish any type of small hole with a total elimination of bell-mouthing which is commonly caused by split-end laps.

Like the eye in a needle, the slit is supported at both ends by solid metal and can be spread to meet size requirements. This feature also provides a resilience that eliminates freezing against the work.

Acro Needle Eye Laps were designed by men like yourself, seasoned in the field of precision manufacture. And it is with their assurance, gained from their own experience, that Acro Needle Eye Laps will provide the best in lapping today.

TWELVE SIZES—EACH CAN BE EXPANDED TO MEET NEXT LARGER SIZE LAP

Small holes which may be finished with Needle Eye Laps range from .062" to .250" diameters. Simply choose a lap that is slightly smaller than the hole that is to be finished. Then spread the slot as desired with the special expander illustrated at right. Expanders are included with each shipment.

Acro Needle Eye Laps come in twelve sizes, and are packed a dozen of a size to a package. Each size can be expanded to meet next larger size.

Lap sizes: .062, .070, .079, .090, .104, .120, .135, .155, $1.50 dozen, $16.95 gross.

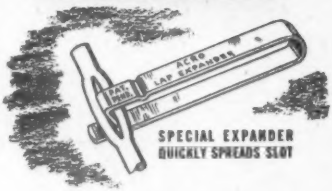
.1718 and .1875—$1.80 dozen, $20.50 gross.

.2187 and .250—$2.20 dozen, $25.10 gross.

Complete Assortment $18.95 gross.

REMEMBER—it's the barrel-shaped, closed end SLIT lap that turns the trick . . . eliminates bell-mouthing.

ORDER NOW—IMMEDIATE DELIVERY



Leading jobbers throughout the nation have ample stocks of Needle Eye Laps on hand in all sizes to make same day shipments.

See Your Jobber or Write —

ACRO TOOL and DIE WORKS

4894 N. Clark St. Phone Longbeach 1807 Chicago 40, Ill.

The Spotlight is on NORBIDE*

*Hardest

Increases Gage-Life *100 times*

NORBIDE Gages are exciting the interest of industry because of their long life and great resistance to wear. Made of the hardest material commercially produced (second only to the diamond in hardness), NORBIDE plug and ring gages and dial indicator gage points will outlast conventional types of measuring devices 100 times and more.

Norton Company supplies NORBIDE gage blanks to gage manufacturers and to concerns making their own gages. Ask your regular gage manufacturer for NORBIDE gages and prove to yourself how the hardest material made by man increases gage life 100 times and more.

For an interesting booklet on NORBIDE gages write to Norton Company for Form No. 1100TD.

NORBIDE is the registered trade name for Norton Boron Carbide — B_4C.

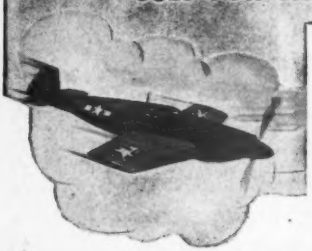
NORTON COMPANY

Worcester 6 Massachusetts

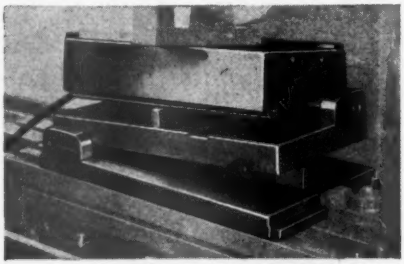
material made by man

ARE YOU TAKING *Full Advantage* OF YOUR MAGNA-SINE'S VERSATILITY?

A LEADING AIRCRAFT MANUFACTURER FINDS MANY USES FOR THIS TIME-SAVING TOOL



"Magna-Sines are used in layout, checking, inspection, light milling and light drilling as well as grinding. The milling and drilling operations are generally done before the permanent jigs and fixtures are built or when only a few pieces are to be made."



There are many places in every shop where the Magna-Sine will save many hours and many dollars. Use it for milling . . . drilling . . . boring . . . grinding . . . or any light operation where the work must be held securely and accurately at an angle.

The Magna-Sine will hold any magnetic material at any single or compound angle accurately and securely, but without distortion. It can be set to a required angle quickly, usually in a matter of seconds. The work is held firmly at the turn of a switch and is released with equal ease.

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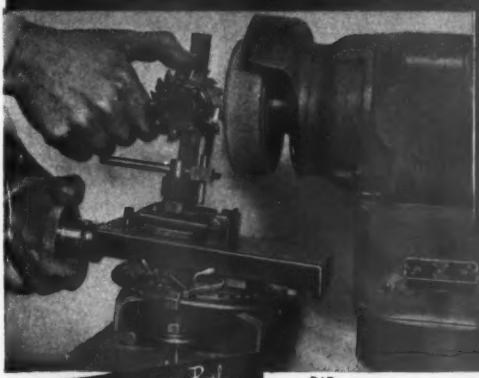

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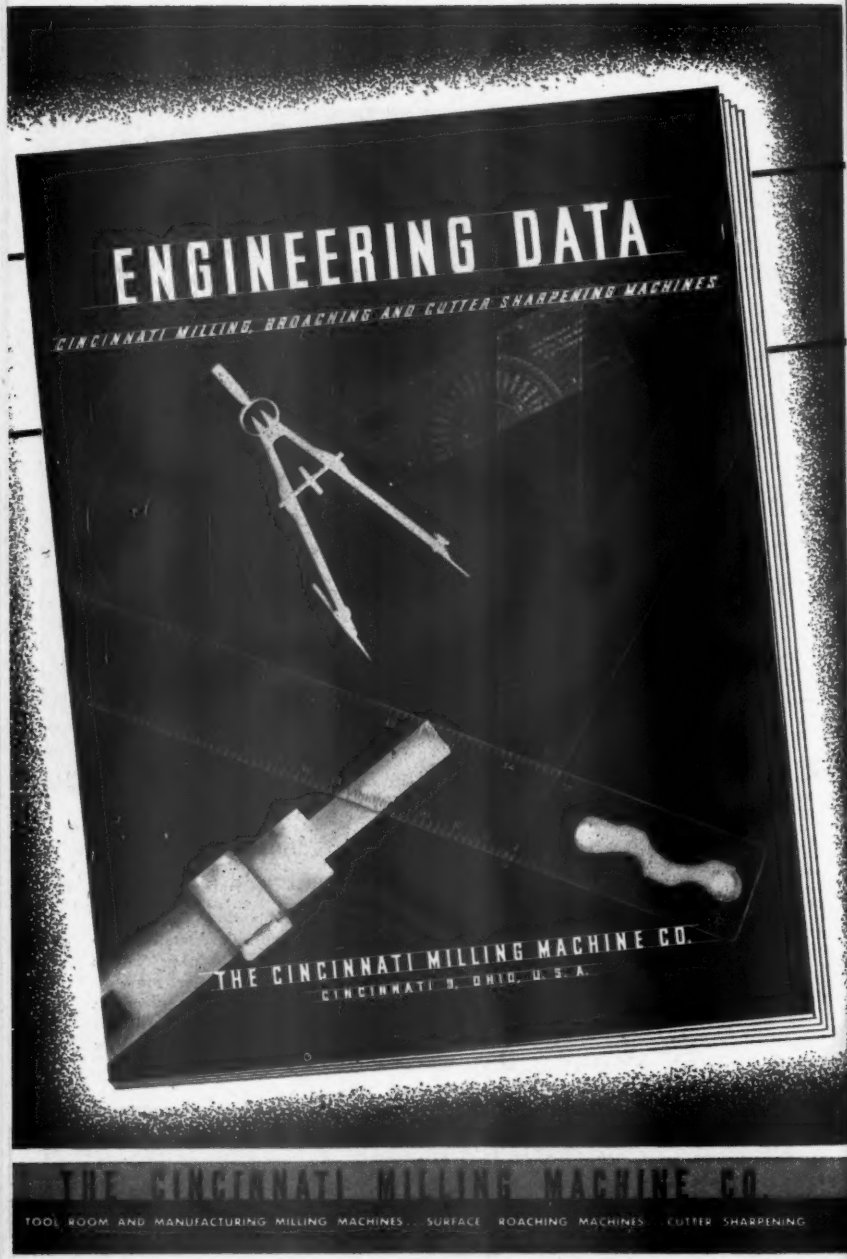
ENGINEERING DATA
CINCINNATI MILLING, BROACHING AND CUTTER SHARPENING MACHINES
THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO, U. S. A.

THE CINCINNATI MILLING MACHINE CO.

TOOL ROOM AND MANUFACTURING MILLING MACHINES... SURFACE ROACHING MACHINES... CUTTER SHARPENING

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For Tool Engineers, Plant Layout Men, Methods Engineers

How many times do you find it necessary to go out in the shop and check machine dimensions when you are working on fixtures? And when the machine is in a shop miles away, days and sometimes weeks are required to obtain the desired dimensions by mail. Now, if you are working with current models of CINCINNATI Milling, Broaching, and Cutter Sharpening Machines, you may obtain all the pertinent engineering information in one catalog weighing a few ounces.

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BEFORE YOU PUT HOLES IN
SHEETS
ANGLES
CHANNELS

Wales Type "B" Units for punching sheet material in stamping presses.

BY *any* METHOD . . . *investigate*

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HOLE PUNCHING EQUIPMENT

Before spending valuable time and effort designing and building special hole punching dies, check with Wales Strippit engineers who may have solved your particular hole-punching problems by using various adaptations of standard Wales Hole Punching Units.

Wales Type "C" Units designed for punching angles and sheets on press brakes.

Join the hundreds of metal fabricators who make it a rule of calling on Wales-Strippit *before* putting holes in sheets, channels, and angles *by any method.*

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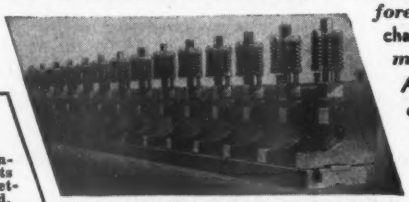

Wales Type "E" Units to punch extruded shapes and channels on press brakes.

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1. Usual time-consuming adjustments of conventional set-ups are eliminated.
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3. Each unit is independent and self-contained.
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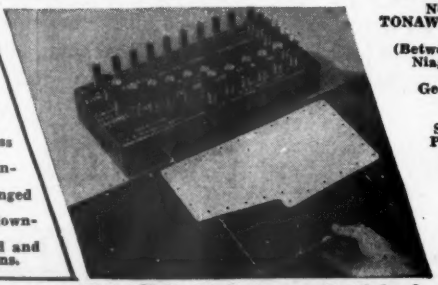
8. Punches may be interchanged without disturbing set-up.
9. Die setting and press "down-time" reduced to minutes.
10. Same units may be used and reused in unlimited patterns.



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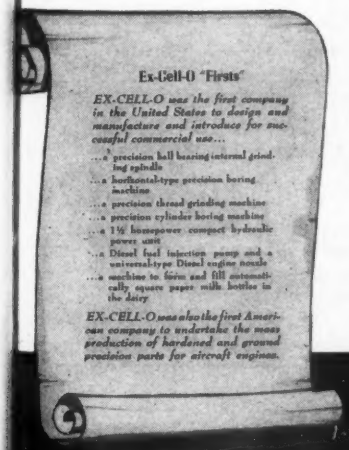
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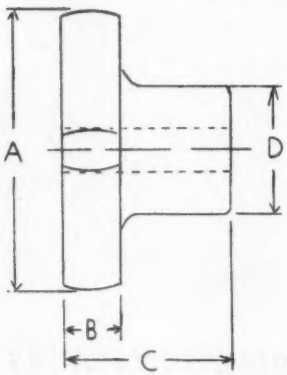

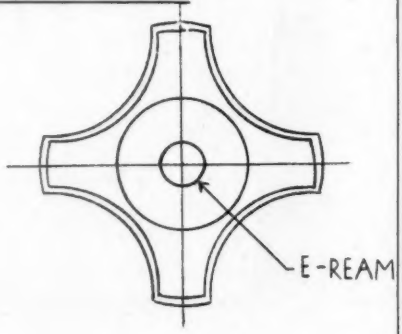

HAND KNOB NO.	A	B	C	D	E	PRICE EACH WITHOUT HOLE	PRICE EACH WITH REAMED HOLE	PRICE EACH WITH THREADED H.
N-1	3/4	1/4	1/2	7/16	3/16	.05	.10	.13
N-2	1-1/8	5/16	5/8	9/16	1/4	.07	.13	.15
N-3	1-1/2	3/8	11/16	3/4	5/16	.09	.15	.17
N-4	2	7/16	13/16	7/8	3/8	.12	.17	.19
N-5	2-1/2	1/2	1-1/2	1-1/8	3/8	.14	.19	.21
N-6	3	1/2	1-1/2	1-1/8	3/8	.16	.21	.23

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The finished work—completed stroke.

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3. Machine slide completes cutting stroke.
4. Fixture returns to out stop.
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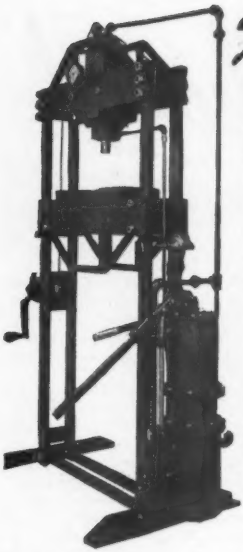
It's the machine, the broach and the unsung design engineers who made this pertinent contribution to production.

The LAPOINTE Machine Tool Company

HUDSON, MASSACHUSETTS, U. S. A.

BROACHES AND BROACHING MACHINES

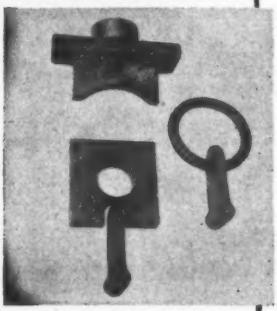


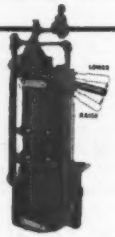
The KRW HYDRAULIC ARBOR PRESS IS AN *Efficient* PRODUCTION MACHINE

EQUIPPED WITH PATENTED KRW SPEEDI-BOOSTER AND USING LOW-COST DIES, IT DOES THE WORK OF EXPENSIVE PRESSES AND BENDING MACHINES ON SHORT-RUN PRODUCTION

● If you could see some of the manufacturing uses to which KRW Hydraulic Presses are being put today, you'd doubt your eyes. Nevertheless, the versatility and adaptability of these air-operated presses is being profitably proven today by many factory and production executives. Heart of the New KRW Speedi-Booster Hydraulic Press is its sensitive finger-tip control mechanism which instantly governs ram movement . . . lower, raise or stop. With a few simple and inexpensive dies these KRW Presses can be adapted to a wide variety of bending and pressing operations requiring pressures from 5 to 75 tons. Air pressure varying from 80 to 225 pounds is required . . . resulting hydraulic pressure varies with air pressure used. Built-in air regulator permits exact duplication of pressure at each stroke . . . important in many types of fast production. Available for either vertical or horizontal operation. Quick delivery on all sizes. Write for KRW Hydraulic Press Bulletin. Our Engineers are at your service. We also manufacture suitable capacity air compressors. K. R. Wilson, 10 Lock St., Buffalo 2, N. Y.

5/8" CRS RING. With the simple dies shown, quickly made from stock steel, this 6-inch ring is made with but four feeding passes into the lower die. Before the radius is completed, the shackle is inserted into the die notch, permitting the ring to "thread the eye" of the shackle. Closing ring by welding completes operation. Equipment: 25-ton KRW Press





THE KRW SPEEDI-BOOSTER WITH FINGER-TIP CONTROL

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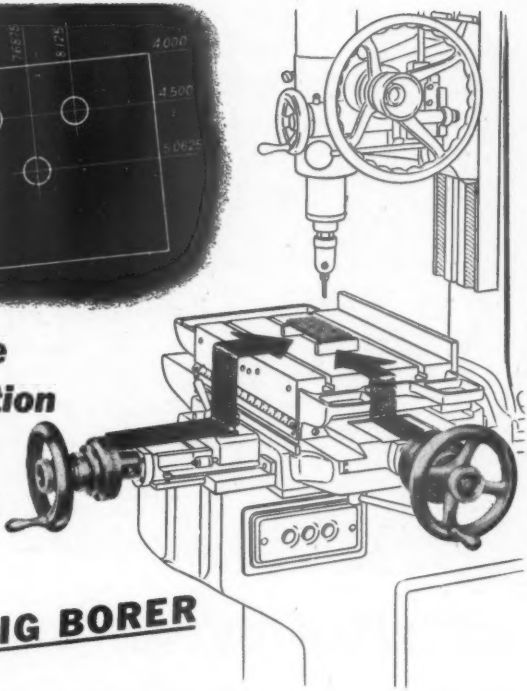

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SPOTS • DRILLS • BORES • REAMS All Holes with Minimum Tool Changes

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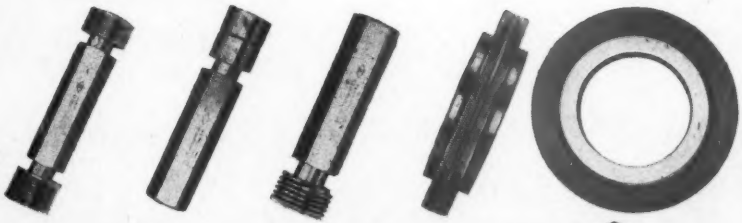

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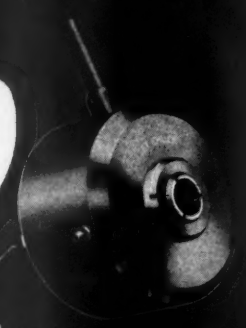
3 ALLISON COLLET CHUCKS



MODEL No. 1 For 1½" 8-thread spindle lathes — with ⅞" collet capacity — is unsurpassed as a combination chuck for either first or second operation work.

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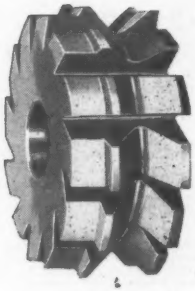

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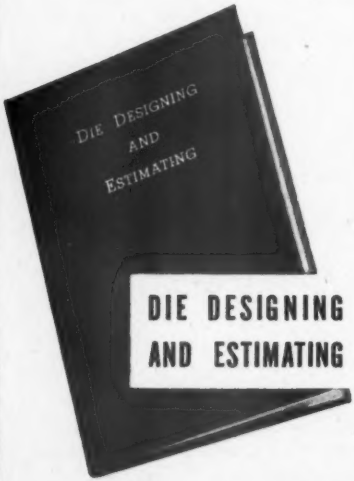

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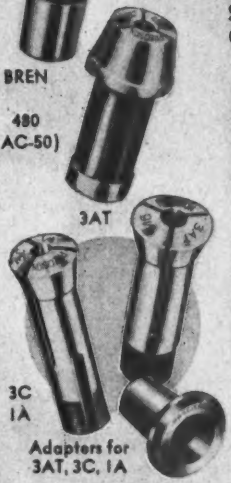

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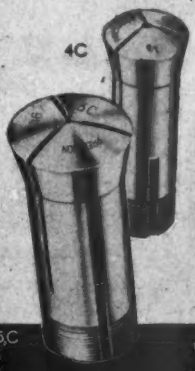

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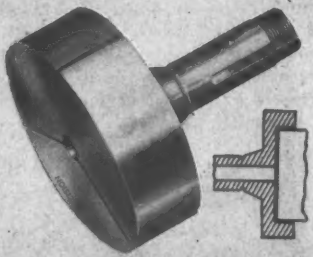

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Coming In August

More important factors governing precision tapping: the proper specifying of taps to insure best results as to thread size and tap life—by R. R. Williams . . . The material that Mr. Williams prepares for the Tool & Die Journal is based on his current and original work in licking the bugs that creep into precision tapping to aircraft engine tolerances . . .

The Single-Blade, High Finish and Close Tolerance Reamer—by Albert W. Ehlers . . . Another factual report in Mr. Ehlers' thorough style, exploring the subject from design and manufacture to surface analysis . . .

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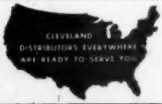


PRIORITY JOB REFERRAL

The topic of the hour seems to be the War Manpower Commission's nation-wide job referral plan, officially known as the "Priority Referral System".

The first reactions to the plan seemed to be those of dismay and confusion. The requirement that all male workers be cleared through the United States Employment Service seemed to foretell the familiar war-time condition known as the bottleneck. It was seriously doubted, and still is, that USES is staffed to enable it to cope with such a large labor turn-over. On the other hand, confusion seems to stem from the fact that each local industrial area has to "work out its own salvation" under a set of general policy regulations set up by the War Manpower Commission in Washington.

The ultimate purpose to be attained by "Priority Referral" is that workers will be directed to war jobs in the order of their relative urgency. This is decidedly desirable, and, in the vernacular of the day "it is a good trick if you can do it!" The early opposition developed not only from Industry organizations but from War Manpower local officials and Labor-Management Committees. As an example, one WMC Area Director is reported to have objected because, in his area, progress in satisfying manpower requirements was just being made when along came war contract cutbacks to upset the apple cart. Now we have a restrictive measure on labor employment. The Wall Street Journal reports that in the Detroit area the Labor-Management Committee unanimously opposed the referral plan. This of course includes the labor members. Under the clause which permits delegation of hiring authority to other organizations, the Detroit WMC may permit a sizable number of large employers to continue their hiring of new workers, but specifically under the direction of USES. In Philadelphia it is suggested that the Civil Service Commission, the Railroad Retirement Board, the War Shipping Administration and even labor unions may have such power delegated to them. Such cooperation should help USES and relieve bottlenecks.

Our first thought about the order was that it partook of regimentation of both employers and employees to the point of subjecting them to an abridgement of their rights as American citizens. For many years fair-minded Americans have asserted the right of every man to work where he would, and the right also of every employer to employ whom he would. Abuses of this right are chargeable against both labor unions and Industry, and now it looked as though a Federal Govern-

ment agency might be setting up a regulation which savors of this same regimentation.

Today as if to offset both vocal and implied dissatisfaction with the plan, there comes a statement from Chairman Paul V. McNutt of the War Manpower Commission, which emphasizes that compulsory assignment of any worker to a job is not provided for in the new manpower Priority Referral System. The policy to be followed by regional and local area boards should be to *direct* workers to jobs for which they are best fitted, the wages for which must be substantially those which the worker has been receiving. There is also the qualification that workers, to the greatest "degree consistent with war needs shall be given freedom of choice as to the jobs they wish to accept". A similar privilege of selection of workers shall be accorded to employers.

A second declaration made by Chairman McNutt provides that a worker shall be given successive job offers "on the basis of their relative urgency in the war effort", and that successive job opportunities be not denied except for "good cause". Three cases cited are:

1. Where the worker, if he accepted the job, would, under the applicable employment stabilization program, be entitled to a statement of availability or be eligible for referral on grounds of under-utilization of skill or less than full-time work.

2. Where wages or working conditions in the offered employment are not reasonably comparable with those prevailing for similar employment in similar establishments in the community.

3. Where the worker's acceptance of the job offered would require him to join or resign from, or refrain from joining a labor organization, contrary to his own wishes in the matter.

A worker may be referred to a "non-essential" job when:

1. He is not needed for any essential job in the area.

2. He is unable to accept an essential job outside the area.

3. His acceptance of an essential job would result in undue hardship or when there are special emergency circumstances or when there is some other good cause for preventing his acceptance.

Chairman McNutt's statement concluded with this declaration: "Any person who claims that any action taken, action denied, or decision rendered with respect to him, with respect to his employer, or with respect to any of his workers under a priority referral program, is unfair or unreasonable as applied to him or is inconsistent with these or other applicable policies and standards or with applicable regulations or programs, may appeal from such action or decision in accordance with War Manpower Commission Regulation No. 5, (regulation relating to appeals.)"

We are glad to have Chairman McNutt's statement which so clarifies misapprehensions of the new job referral order. We hope our briefed reproduction of it will be helpful to many workers, employers and department heads.

Geo. Huebner

Editor

Applying HSS and Cast Alloy Welding Rod to Tool Manufacture and Salvage

by Albert W. Ehlers
McQuay-Norris Mfg. Co.
Connersville Division

Air-hardening, high speed steel welding rod has many uses in the tool grinding, tool salvage and tool manufacturing departments. This rod is adequately applied with the oxygen-acetylene torch and by careful "fusing" with an excess acetylene flame, a solid deposit of any reasonable depth may be achieved without gas or blow-holes. A bead approximately one half the diameter of the rod may be applied over an area with subsequently applied beads building up the deposit to a desired "mat" depth.

The "fusing" process used in applying this type of welding rod is very similar to the standard practice used when welding with cast iron rod on a cast iron weld. The only deviation is that no flux is necessary in order to make a solid weld free from oxidation or blow-holes.

Successful "mats" or beads have been layed to a depth of two inches or more without evident blow-holes, fissure cracks or bead separation. If the welded surface is to be subjected to severe impact or severe pressure the welded area should be drawn at 600°-650° F to relieve welding strains set up between successively welded layers or mats. A single bead weld application need not be heat treated as indicated.

There are several good air-hardening, high speed steel welding rods procureable on the market. They all appear to be of a mold cast type rod and therefore are not available in the smaller diameters that might be selected if drawn wire rods were considered. The cast rods are quite brittle and in their standard lengths cannot be centerless ground successfully. However, as many rather delicate repair jobs require a small diameter rod, the tool salvage department may decide to send cut-off lengths of approximately four inches through the centerless grinding line. Enough rod may thus be prepared at one grinder setting for quite a long period of operation; hence it does not require frequent excursions into a crowded production line. The writer finds that a supply of $\frac{1}{8}$" and $\frac{3}{16}$" diameter rod sections will answer most delicate repair problems. The ground, four inch, sections are tack welded onto standard filler rod of similar diameter for easy application to the job.

The writer's best experience with an air-hardening, high speed steel welding rod has been with a molybdenum type high speed steel such as that produced by the Gorham Tool Company, Detroit, Michigan. However, several other rods were tried from other vendors with good success.

The writer's best experience with a cast alloy, non-ferrous, rod has been with several grades of Stellite as produced by the Haynes Stellite Corporation, Kokomo, Indiana.

Tool Salvage and Repair

A regular use of the air-hardening, high speed steel rod is in repairing chipped milling cutter teeth. The full width of the cutter tooth must be ground away to a depth below that at which the cutter is to operate. This is necessary because immediately adjacent to the weld, the regularly hardened high speed steel of the original cutter metal will lose from 10-15 points hardness as measured on the Rockwell C scale. This is due to heat flow from the weld area. The heat flow will usually confine itself to the tooth being welded. The entire new surface as welded will check from 61 to 63 Rockwell C, therefore all of the tooth cutting surface should be weld metal.

If form relieved cutters are to be

repaired, it has been found that an angular relief may be substituted on a few teeth without injuring cutter operation. The angular profiled relief may be achieved by a small profiled grinding wheel on a tool and cutter grinder.

Another regular use of the air-hardening, high speed steel rod is to repair chipped centerless grinding blades. Immediately adjacent to the weld, the original surface hardness of the blade may be affected as indicated in a previous paragraph, but this drop in surface hardness on the average blade will be only a few points and will not appreciably affect the blade life.

Cracked or chipped blades with Stellite inserts may be repaired by the use of the Stellite rod in much the same manner. If much braze metal between the insert and blade proper is lost this can be remedied by applying flux and silver solder while the weld is still hot. The silver solder will flow into the gaps left by the lost brazing material.

The reader, if he is familiar with centerless grinding operations, will recognize the fact that the centerless grinding wheel profiling cams are extremely hard to design and manufacture when close tolerance, profiled plunge cuts are desired. This is not due to difficulty in mathematical mensuration but because of individual machine variables and also variables in grinding wheel characteristics. When such a cam is first tried on a job it may be found that the best attention to design and manufacture may be defeated by the machine and grinding wheel variables mentioned. To offset this, metal may have to be added as grinding stock on the cam for a cut and try fit. The air-hardening, high speed steel rod may be used to great advantage here by providing an easy method of applying hard metal to the cam contour without subsequent heat treating operations on the cam proper.

Welded Construction of New Tools

There are also many uses for this type high speed rod in new tool manufacture. One particular instance is an oil hole boring type tool for small ID's on automatic screw machine operation. This tool formerly was made of annealed high speed steel and was rather difficult to manufacture because of thread cutting and the drilling of a long, small diameter hole. The tool, after heat treating and drawing naturally was quite brittle and was very short lived. After many salvage operations were performed on both the shank and cutting surfaces, it was decided to manufacture the tool of tough Stentor type steel, case harden, and to apply the cutting surfaces by use of the high speed rod. This provided a tough shank and subsequent retipping with rod made a few of these boring tools go a long way toward reduced tool inventory and tool cost.

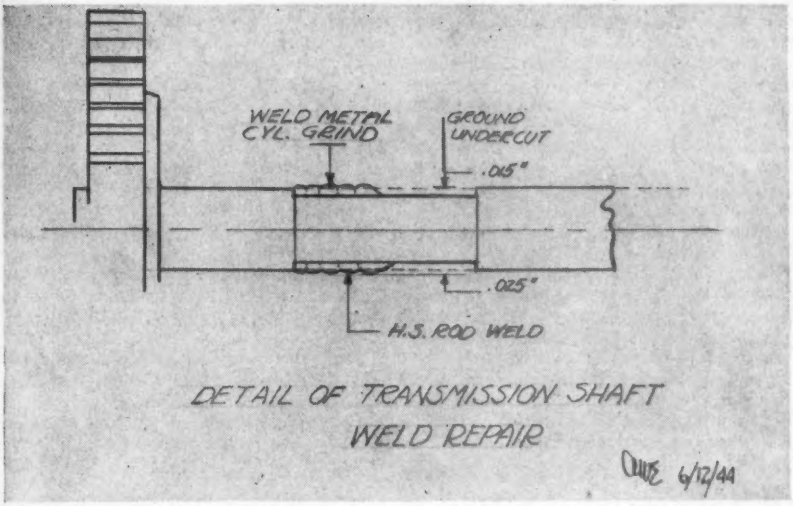
Another instance in new tool manufacture where the high speed rod is an invaluable assistant is in the experimental or new parts department. Many standard or special tools may be easily altered for trial use without the necessity of going thru the regular tool room procedure of set-ups on milling machines and shapers and subsequent heat treating and grinding. Dove-tailed form tools and circular form tools used on previous production may, by welding, be altered for experimental runs in a fraction of the time necessary to produce the tool from bar stock.

Experimental flat form tools may be quickly and cheaply made by using flat, cold-rolled bar stock and applying high speed rod to necessary cutting surfaces.

An Emergency Repair

Aside from tool room applications, high speed welding rod has many other applications in the average manufacturing plant. An instance of this is the repair of a speed reducing transmission spline and gear shaft. This shaft and gear were made as an integral part and the shaft became galled and chewed up due to faulty lubrication. The shaft OD supported the inner race of a precision ball bearing and must of necessity be ground to close tolerance both as to OD and concentricity with the axis of the gear. The first method of salvage that came to mind was the use of the metallizing spray gun. However, as this approach involved the necessity of preparing the surface by undercutting and knurling this could not be accomplished on the hardened shaft unless annealing and rehardening operations were undertaken or unless a special nickel electrode roughing tool was procured.

It was decided to salvage the shaft by use of the air hardening, high speed rod. The galled bearing surface was undercut on a cylindrical grinder to about .015"



Procedure for effecting repair of transmission shaft by putting on a mat of air-hardening, high speed steel rod. That surface of the shaft supporting a ball bearing inner race had been ruined by lubrication failure. The technique described by Mr. Ehlers resulted in a surface having greater hardness and better metal structure than the original.

beneath the shaft OD. The next set-up was made between bench centers for the application of the rod. The weld was accomplished by putting on a mat of approximately .025" with air hardening rod. The gear and splines were protected by water soaked asbestos paper so that their original hardness would not be affected by the welding heat. The weld bead was accomplished by preparing numerous circular and adjacent beads much as one would string doughnuts on a stick.

The entire shaft and gear were next drawn at 650° F to remove all chance of welding strain and the OD was reground to the correct size. This shaft is still in continuous operation; the surface supporting the bearing having a better hardness and metal structure than that of the original part.

In repairing gears, etc., where Rockwell C 61 to 63 is not necessary and where the subsequent brittleness is a detriment, the air-hardening rod can be used and the welded portion can be reduced in hardness to approximately 50 to 55 by careful use of the welding torch after the original weld has completely cooled. A color comparison chart for a temperature near 1050° F will usually enable the welder to match the colors so the welded area will drop to the aforementioned 50 to 55, Rockwell C.

Welded Construction of Form Tools

The writer, in his attempt to conserve high speed steel and to produce flat form tools quickly and cheaply without resorting to contour milling of annealed stock, has made many such tools using cold-rolled flat bar stock with tips of cast alloy such as Tantung G, Rexalloy, Stellite, etc.

If the tool is of simple design, the tips are attached to the cold-rolled stock by either silver solder, tobin bronze or the low temperature eutectic alloys and the subsequent form grinding can be accomplished without too much time being expended in removing the hard cast alloy. However, if a deep forming cut is to be made, the time required to make this profile by grinding and the accompanying grinding wheel consumption sometimes offset time and material gained over the regular method of tool room manufacture from annealed high speed steel stock.

In subsequent experiments with this

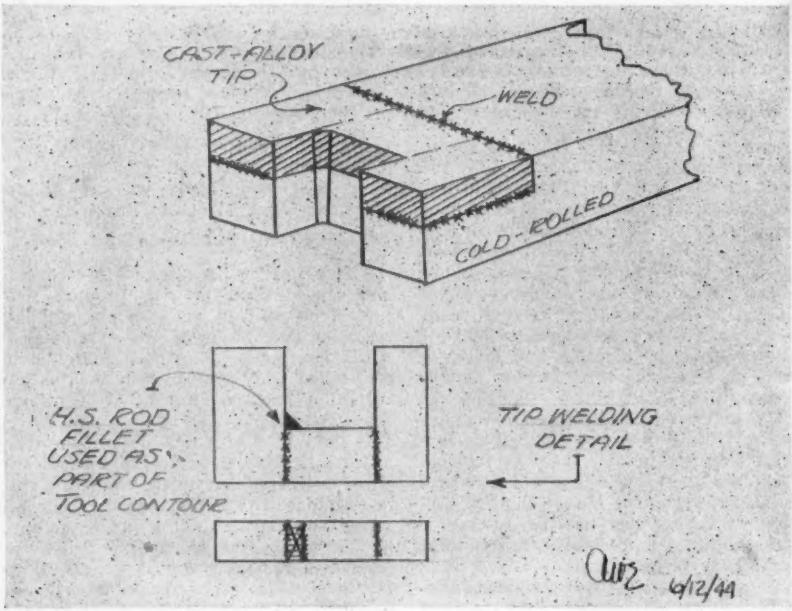
type of tool, the writer found, in the absence of cast contour tips, that these contours could be easily accomplished by welding the cast alloy pieces together with high speed, air-hardening welding rod to form a contour tip. This rod seems particularly adapted to forming a good weld with the cast alloys and thus presents an area of cast alloy which Rockwells C 61 to 64, and joining welds of high speed steel rod which Rockwells C 60 to 63.

Contour tips thus manufactured are attached to cold-rolled shanks in the regular manner after surface grinding to remove weld surface variables.

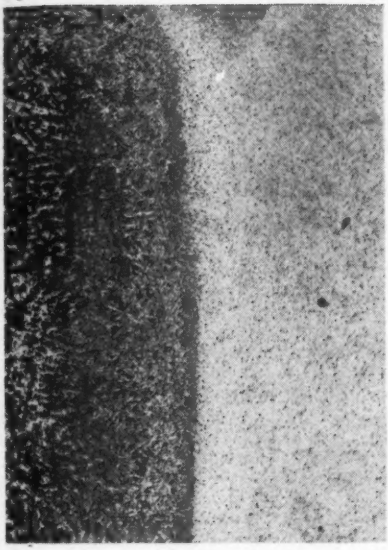
If the tool might be subject to chipping due to design or application, the tip should be attached to the shank by welding with high speed rod. Thus, if small chips or portions of the tool crack off, they can be repaired by welding or building up with the same air-hardening rod. The heat of the welding will not disturb the welded tip as would be the case if the tip was secured by a brazing medium such as silver solder. Of course the heat of welding will not affect the adjacent (cast alloy) hardness as it would if the tool were made of high speed steel.

In running tests with a tool made with the composite tips of cast alloy and air-hardening high speed steel rod, the writer cannot find any appreciable difference in tool life between the adjacent areas if the surface speeds are kept within 90-110 SFM.

The accompanying photomicrographs show two pieces of cast alloy, Tantung G, welded in one instance with Gorham high speed welding rod and in the other with Stellite welding rod. The weld boundary between the high speed rod



Flat form tools of simple profile can be made up of a cast-alloy tip welded with air-hardening, high speed steel rod to a cold-rolled shank. Form tools of more intricate profile can successfully employ composite tips "pre-formed" by welding together, with air-hardening, high speed steel rod, sections of cast-alloy material. The sections should be arranged in a pattern approximating, as nearly as possible, the finished profile in order to leave a minimum of stock to be removed by grinding.



Sharply defined weld boundary between Gorham air-hardening, high speed steel welding rod (left) and cast-alloy Tantung G (right). Photomicrography: 24 NA Objective. 7.5 X Eyepiece. 100X Magnification. Aqua Regia etch. Reduction for reproduction, about 50%.

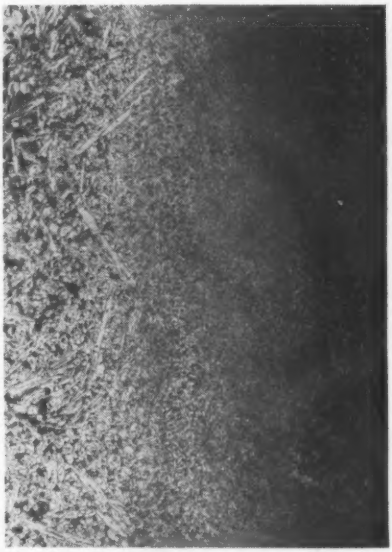
and the cast alloy shows a well defined line. The weld boundary between the Stellite rod and the cast alloy shows quite a bit more diffusion between the weld and the parent alloy. These photomicrographs were taken with a standard No. 24 NA objective and a 7.5 X eyepiece giving a wide field lens combination. The specimens were etched by the use of Aqua Regia.

Impact tests (conducted in rather an elementary manner) show that the sharply defined boundary between the high speed rod and cast alloy is as strong or stronger than the more diffused boundary between the Stellite rod and cast alloy. Rockwell tests on the Stellite weld show C 58 to 59 as against the C 60 to 63 of the high speed rod weld. The Stellite rod deposit does not seem to have the excellent "red" hardness that regular stellite tool blanks and tips possess.

No attempt is to be made by the writer to expound at length concerning the metallurgical results of this welding procedure as he merely has a nodding acquaintance with the field in general. However, the experiment stands on its empirical legs and also on actual results in metal cutting operations.

The idea of building tools with blocks of cast alloy and joining them with air-hardening high speed steel rod may seem rather far fetched to many tool engineers and to shop men in general. However, the speed and ease of assembly in this manner should be investigated by the more sceptical of mind with this admonition—"don't condemn without first trying".

In conclusion, the foregoing may suggest many more pertinent applications of air-hardening, high speed steel welding rod with its affinity to the cast alloys than has been attempted by the writer. If this be the case, then the preparation of this article will be justified.



Diffused weld boundary between Stellite Welding rod (left) and cast-alloy Tantung G (right). Photomicrography: 24 NA Objective. 7.5 Eyepiece. 100X Magnification. Aqua Regia etch. Reduction for reproduction, about 50%.

Developments in Precision Tapping

and

Correct Tap Nomenclature

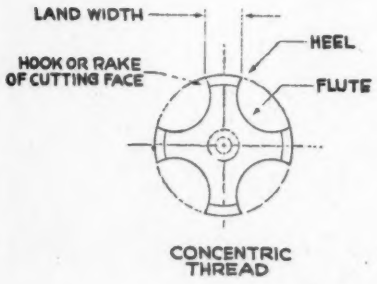
by R. R. Williams

Thread Engineer

In any organization, the man who is responsible for the taps used to produce precision threaded holes has, in all probability, given a great deal of thought as to why all taps cut larger than their own pitch diameters.

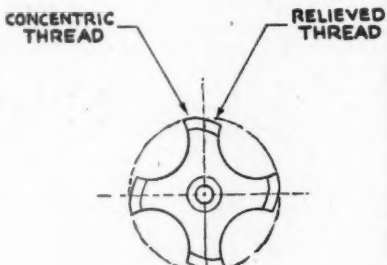
There are a number of reasons why taps cut larger than we would expect from their measured pitch diameters. Most of the reasons are matters of design and manufacture.

There is, however, one reason to expect a tap to cut larger than its own pitch diameter that cannot be corrected



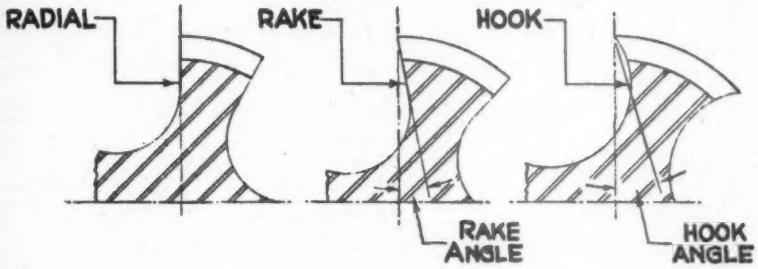
by design and I believe this should be considered first.

In discussing this condition, let us assume that the starting chamfer or the point is ground concentric with the pitch diameter. Now, if the tap had simply a series of V-shaped grooves such as constitute a thread hob, then the chamfer on each flute would be broken by an equal number of notches and the respective notches of the chamfers would be symmetrically opposite one another. But on a tap however, the vee is a spiral or helix and this causes a relatively uneven spacing or unsymmetrical arrangement of the notches on the chamfers so that the chamfer of a



given flute does not have the same area of cut at its point or moment of contact with the drilled hole as do the chamfers of the other flutes, all of which vary, one compared with another.

To further substantiate this, let us consider a two-flute tap. On the chamfer of this tap, we would have, at the start of the cut, a V-notch in contact with one side of the drilled hole, and the flat, unbroken chamfer contacting the other side. This, one can readily see, would cause the axis of the tap to be driven in an eccentric circle.



We have tested taps with two, three and four flutes, having the same pitch diameter and the same chamfer, with the following results: the two-flute cut largest, the three-flute next, and the four-flute cut closest to the measured pitch diameter.

These tests were made with a tapping machine and a lead screw. All holes were reamed with the same reamer and relieved to the same depth.

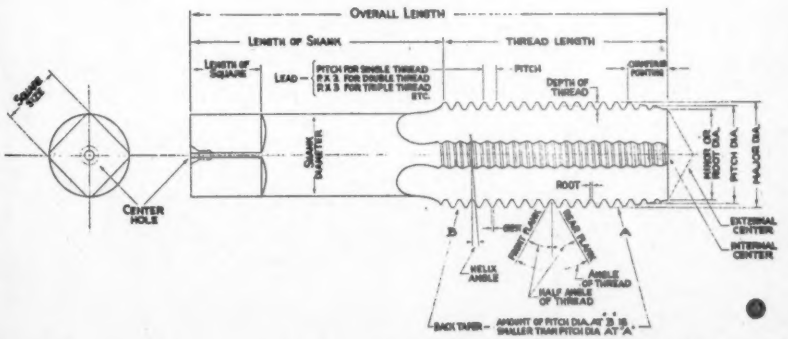
The tests were made in aluminum as this material is usually more sensitive to variations in taps than most other materials. Both $\frac{1}{4}$-18 and $\frac{3}{8}$-16 taps were used. The two-flute taps cut an average .0006" larger on pitch diameter than the four-flute and the three-flute cut an average .0003" larger.

These results are in line with, and substantiate, the foregoing analysis of the over-size cutting action caused by the unsymmetrical tap flute chamfers. The two-flute taps represented this action at its extreme, i. e., at the point or instant of contact one notched chamfer and one flat chamfer engage the material thus resulting in the greatest possible eccentric thrust per chamfer, and that thrust is exerted by the one chamfer having the greatest initial cutting edge in contact. As we increase the number of flutes, that same greatest possible eccentric thrust becomes, of necessity, distributed among more flutes and acts, correspondingly, in several different radial directions instead of only the one in the case of the two-flute taps. Hence the resultant total eccentricity (or over-size cutting action) is minimized. As verified in the tests, the four-flute taps cut closest to their actual pitch diameter.

We have also found that, in general, a tap chamfer can run-out (total indicator reading) as much as .003" in relation to the pitch diameter before it materially affects the cutting size of the tap.

Further investigations are being made of this interesting aspect of the geom-

(TO PAGE 104—PLEASE)



● Due to space limitations, brief instructions covering this month's tables appear on page 109

MATERIALS[1] WEIGHT[2] TABLES (T&DJ Condensed Arrangement) — PART III[3]

Calculated and Compiled by Geo. H. Thompson

	3 13/16" x		3 7/8" x		3 15/16" x		4" x		4 1/16" x		4 1/8" x	
1"	1081.23	1"	1098.95	1"	1116.68	1"	1134.40	1"	1152.13	1"	1169.85
2"	2162.45	2"	2197.90	2"	2233.35	2"	2268.80	2"	2304.25	2"	2339.70
3"	3243.68	3"	3296.85	3"	3350.03	3"	3403.20	3"	3456.38	3"	3509.55
4"	4324.90	4"	4395.80	4"	4466.70	4"	4537.60	4"	4608.50	4"	4679.40
5"	5406.13	5"	5494.75	5"	5583.38	5"	5672.00	5"	5760.63	5"	5849.25
6"	6487.35	6"	6593.70	6"	6700.05	6"	6806.40	6"	6912.75	6"	7019.10
7"	7568.58	7"	7692.65	7"	7816.73	7"	7940.80	7"	8064.88	7"	8188.95
8"	8649.80	8"	8791.60	8"	8933.40	8"	9075.20	8"	9217.00	8"	9358.80
9"	9731.03	9"	9890.55	9"	10050.10	9"	10209.60	9"	10369.10	9"	10528.70
10"	10812.30	10"	10989.50	10"	11166.80	10"	11344.00	10"	11521.30	10"	11698.50
11"	11893.50	11"	12088.50	11"	12283.40	11"	12478.40	11"	12673.40	11"	12868.40
12"	12974.70	12"	13187.40	12"	13400.10	12"	13612.80	12"	13825.50	12"	14038.20
1/16"	67.58	1/16"	68.69	1/16"	69.80	1/16"	70.90	1/16"	72.01	1/16"	73.12
1/8"	135.16	1/8"	137.37	1/8"	139.59	1/8"	141.80	1/8"	144.02	1/8"	146.23
3/16"	202.73	3/16"	206.06	3/16"	209.38	3/16"	212.70	3/16"	216.02	3/16"	219.35
1/4"	270.31	1/4"	274.74	1/4"	279.17	1/4"	283.60	1/4"	288.03	1/4"	292.46
5/16"	337.88	5/16"	343.42	5/16"	348.96	5/16"	354.50	5/16"	360.04	5/16"	365.58
3/8"	405.46	3/8"	412.11	3/8"	418.75	3/8"	425.40	3/8"	432.05	3/8"	438.69
7/16"	473.04	7/16"	480.79	7/16"	488.55	7/16"	496.30	7/16"	504.05	7/16"	511.81
1/2"	540.61	1/2"	549.48	1/2"	558.34	1/2"	567.20	1/2"	576.06	1/2"	584.93
9/16"	608.19	9/16"	618.16	9/16"	628.13	9/16"	638.10	9/16"	648.07	9/16"	658.04
5/8"	675.77	5/8"	686.84	5/8"	697.92	5/8"	709.00	5/8"	720.08	5/8"	731.16
11/16"	743.34	11/16"	755.53	11/16"	767.71	11/16"	779.90	11/16"	792.09	11/16"	804.27
3/4"	810.92	3/4"	824.21	3/4"	837.51	3/4"	850.80	3/4"	864.09	3/4"	877.39
13/16"	878.50	13/16"	892.90	13/16"	907.30	13/16"	921.70	13/16"	936.10	13/16"	950.50
7/8"	946.07	7/8"	961.58	7/8"	977.09	7/8"	992.60	7/8"	1008.11	7/8"	1023.62
15/16"	1013.65	15/16"	1030.27	15/16"	1046.88	15/16"	1063.50	15/16"	1080.12	15/16"	1096.73

[1]Based on a steel of 1 cu. in. = .2836 lb.

[2]Multiply constant by stock thickness in thousandths of an inch to get weight in pounds per thousand pieces

[3]Part I, Tool & Die Journal, May 1944
Part II, Tool & Die Journal, June, 1944

[1]Based on a steel of 1 cu. in. = .2836 lb.

[2]Multiply constant by stock thickness in thousandths of an inch to get weight in pounds per thousand pieces

Part II, Tool & Die Journal, June, 1944

MATERIALS[1] WEIGHT[2] TABLES (T&DJ Condensed Arrangement)

Calculated and Compiled by Geo. H. Thompson

	4 3/16" x		4 1/4" x		4 5/16" x		4 3/8" x		4 7/16" x		4 1/2" x
1"	1187.58	1"	1205.30	1"	1223.03	1"	1240.75	1"	1258.48	1"	1276.20
2"	2375.15	2"	2410.60	2"	2446.05	2"	2481.50	2"	2516.95	2"	2552.40
3"	3562.73	3"	3615.90	3"	3669.08	3"	3722.25	3"	3775.43	3"	3828.60
4"	4750.30	4"	4821.20	4"	4892.10	4"	4963.00	4"	5033.90	4"	5104.80
5"	5937.88	5"	6026.50	5"	6115.13	5"	6203.75	5"	6292.38	5"	6381.00
6"	7125.45	6"	7231.80	6"	7338.15	6"	7444.50	6"	7550.85	6"	7657.20
7"	8313.03	7"	8437.10	7"	8561.18	7"	8685.25	7"	8809.33	7"	8933.40
8"	9500.60	8"	9642.40	8"	9784.20	8"	9926.00	8"	10067.80	8"	10209.60
9"	10688.20	9"	10847.70	9"	11007.20	9"	11166.80	9"	11326.30	9"	11485.80
10"	11875.80	10"	12053.00	10"	12230.30	10"	12407.50	10"	12584.80	10"	12762.00
11"	13063.30	11"	13258.30	11"	13453.30	11"	13648.30	11"	13843.20	11"	14038.20
12"	14250.90	12"	14463.60	12"	14676.30	12"	14889.00	12"	15101.70	12"	15314.40
1/16"	74.22	1/16"	75.33	1/16"	76.44	1/16"	77.55	1/16"	78.65	1/16"	79.76
1/8"	148.45	1/8"	150.66	1/8"	152.88	1/8"	155.09	1/8"	157.31	1/8"	159.53
3/16"	222.67	3/16"	225.99	3/16"	229.32	3/16"	232.64	3/16"	235.96	3/16"	239.29
1/4"	296.89	1/4"	301.33	1/4"	305.76	1/4"	310.19	1/4"	314.62	1/4"	319.05
5/16"	371.12	5/16"	376.66	5/16"	382.20	5/16"	387.73	5/16"	393.27	5/16"	398.81
3/8"	445.34	3/8"	451.99	3/8"	458.64	3/8"	465.28	3/8"	471.93	3/8"	478.58
7/16"	519.56	7/16"	527.32	7/16"	535.07	7/16"	542.83	7/16"	550.58	7/16"	558.34
1/2"	593.79	1/2"	602.65	1/2"	611.51	1/2"	620.38	1/2"	629.24	1/2"	638.10
9/16"	668.01	9/16"	677.98	9/16"	687.95	9/16"	697.92	9/16"	707.89	9/16"	717.86
5/8"	742.23	5/8"	753.31	5/8"	764.39	5/8"	775.47	5/8"	786.55	5/8"	797.63
11/16"	816.46	11/16"	828.64	11/16"	840.83	11/16"	853.02	11/16"	865.20	11/16"	877.39
3/4"	890.68	3/4"	903.98	3/4"	917.27	3/4"	930.56	3/4"	943.86	3/4"	957.15
13/16"	964.90	13/16"	979.31	13/16"	993.71	13/16"	1008.11	13/16"	1022.51	13/16"	1036.91
7/8"	1039.13	7/8"	1054.64	7/8"	1070.15	7/8"	1085.66	7/8"	1101.17	7/8"	1116.68
15/16"	1113.35	15/16"	1129.97	15/16"	1146.59	15/16"	1163.20	15/16"	1179.82	15/16"	1196.44

[1]Based on a steel of 1 cu. in. = .2836 lb.

[2]Multiply constant by stock thickness in thousandths of an inch to get weight in pounds per thousand pieces

MATERIALS[1] WEIGHT[2] TABLES (T&DJ Condensed Arrangement)

Calculated and Compiled by Geo. H. Thompson

	4 9/16" x		4 5/8" x		4 11/16" x		4 3/4" x		4 13/16" x		4 7/8" x
1"	1293.93	1"	1311.65	1"	1329.38	1"	1347.10	1"	1364.83	1"	1382.55
2"	2587.85	2"	2623.30	2"	2658.75	2"	2694.20	2"	2729.65	2"	2765.10
3"	3881.78	3"	3934.95	3"	3988.13	3"	4041.30	3"	4094.48	3"	4147.65
4"	5175.70	4"	5246.60	4"	5317.50	4"	5388.40	4"	5459.30	4"	5530.20
5"	6469.63	5"	6558.25	5"	6646.88	5"	6735.50	5"	6824.13	5"	6912.75
6"	7763.55	6"	7869.90	6"	7976.25	6"	8082.60	6"	8188.95	6"	8295.30
7"	9057.48	7"	9181.55	7"	9305.63	7"	9429.70	7"	9553.78	7"	9677.85
8"	10351.40	8"	10493.20	8"	10635.00	8"	10776.80	8"	10918.60	8"	11060.40
9"	11645.30	9"	11804.90	9"	11964.40	9"	12123.90	9"	12283.40	9"	12442.95
10"	12939.30	10"	13116.50	10"	13293.80	10"	13471.00	10"	13648.30	10"	13825.50
11"	14233.20	11"	14428.20	11"	14623.10	11"	14818.10	11"	15013.10	11"	15208.10
12"	15527.10	12"	15739.80	12"	15952.50	12"	16165.20	12"	16377.90	12"	16590.60
1/16"	80.87	1/16"	81.98	1/16"	83.09	1/16"	84.19	1/16"	85.30	1/16"	86.41
1/8"	161.75	1/8"	163.96	1/8"	166.18	1/8"	168.39	1/8"	170.61	1/8"	172.82
3/16"	242.62	3/16"	245.94	3/16"	249.26	3/16"	252.58	3/16"	255.90	3/16"	259.23
1/4"	323.48	1/4"	327.91	1/4"	332.34	1/4"	336.78	1/4"	341.21	1/4"	345.64
5/16"	404.35	5/16"	409.89	5/16"	415.43	5/16"	420.97	5/16"	426.51	5/16"	432.05
3/8"	485.22	3/8"	491.87	3/8"	498.52	3/8"	505.16	3/8"	511.81	3/8"	518.46
7/16"	566.09	7/16"	573.85	7/16"	581.60	7/16"	589.36	7/16"	597.11	7/16"	604.87
1/2"	646.96	1/2"	655.83	1/2"	664.69	1/2"	673.55	1/2"	682.41	1/2"	691.28
9/16"	727.83	9/16"	737.80	9/16"	747.77	9/16"	757.74	9/16"	767.71	9/16"	777.68
5/8"	808.70	5/8"	819.78	5/8"	830.86	5/8"	841.94	5/8"	853.02	5/8"	864.09
11/16"	889.57	11/16"	901.76	11/16"	913.95	11/16"	926.13	11/16"	938.32	11/16"	950.50
3/4"	970.44	3/4"	983.74	3/4"	997.03	3/4"	1010.33	3/4"	1023.62	3/4"	1036.91
13/16"	1051.31	13/16"	1065.72	13/16"	1080.12	13/16"	1094.52	13/16"	1108.92	13/16"	1123.32
7/8"	1132.18	7/8"	1147.69	7/8"	1163.20	7/8"	1178.71	7/8"	1194.22	7/8"	1209.73
15/16"	1213.05	15/16"	1229.67	15/16"	1246.29	15/16"	1262.91	15/16"	1279.52	15/16"	1296.14

[1]Based on a steel of 1 cu. in. = .2836 lb.

[2]Multiply constant by stock thickness in thousandths of an inch to get weight in pounds per thousand pieces

MATERIALS[1] WEIGHT[2] TABLES (T & D J Condensed Arrangement)

Calculated and Compiled by Geo. H. Thompson

	4 15/16" x		5" x		5 1/16" x		5 1/8" x		5 3/16" x		5 1/4" x
1"	1400.28	1"	1418.00	1"	1435.73	1"	1453.45	1"	1471.18	1"	1488.90
2"	2800.55	2"	2836.00	2"	2871.45	2"	2906.90	2"	2942.35	2"	2977.80
3"	4200.83	3"	4254.00	3"	4307.18	3"	4360.35	3"	4413.53	3"	4466.70
4"	5601.10	4"	5672.00	4"	5742.90	4"	5813.80	4"	5884.70	4"	5955.60
5"	7001.38	5"	7090.00	5"	7178.63	5"	7267.25	5"	7355.88	5"	7444.50
6"	8401.65	6"	8508.00	6"	8614.35	6"	8720.70	6"	8827.05	6"	8933.40
7"	9801.93	7"	9926.00	7"	10050.10	7"	10174.20	7"	10298.20	7"	10422.30
8"	11202.20	8"	11344.00	8"	11485.80	8"	11627.60	8"	11769.40	8"	11911.20
9"	12602.50	9"	12762.00	9"	12921.50	9"	13081.10	9"	13240.60	9"	13400.10
10"	14002.80	10"	14180.00	10"	14357.30	10"	14534.50	10"	14711.80	10"	14889.00
11"	15403.00	11"	15598.00	11"	15793.00	11"	15988.00	11"	16182.90	11"	16377.90
12"	16803.30	12"	17016.00	12"	17228.70	12"	17441.40	12"	17654.10	12"	17866.80
1/16"	87.52	1/16"	88.63	1/16"	89.74	1/16"	90.85	1/16"	91.95	1/16"	93.06
1/8"	175.04	1/8"	177.25	1/8"	179.47	1/8"	181.68	1/8"	183.90	1/8"	186.11
3/16"	262.55	3/16"	265.88	3/16"	269.20	3/16"	272.52	3/16"	275.85	3/16"	279.17
1/4"	350.07	1/4"	354.50	1/4"	358.93	1/4"	363.36	1/4"	367.79	1/4"	372.23
5/16"	437.59	5/16"	443.13	5/16"	448.66	5/16"	454.20	5/16"	459.74	5/16"	465.28
3/8"	525.10	3/8"	531.75	3/8"	538.40	3/8"	545.04	3/8"	551.69	3/8"	558.34
7/16"	612.62	7/16"	620.38	7/16"	628.13	7/16"	635.88	7/16"	643.64	7/16"	651.39
1/2"	700.14	1/2"	709.00	1/2"	717.86	1/2"	726.73	1/2"	735.59	1/2"	744.45
9/16"	787.65	9/16"	797.63	9/16"	807.60	9/16"	817.57	9/16"	827.54	9/16"	837.51
5/8"	875.17	5/8"	886.25	5/8"	897.33	5/8"	908.41	5/8"	919.48	5/8"	930.56
11/16"	962.69	11/16"	974.88	11/16"	987.06	11/16"	999.25	11/16"	1011.43	11/16"	1023.62
3/4"	1050.21	3/4"	1063.50	3/4"	1076.79	3/4"	1090.09	3/4"	1103.38	3/4"	1116.68
13/16"	1137.72	13/16"	1152.13	13/16"	1166.53	13/16"	1180.93	13/16"	1195.33	13/16"	1209.73
7/8"	1225.24	7/8"	1240.75	7/8"	1256.26	7/8"	1271.77	7/8"	1287.28	7/8"	1302.79
15/16"	1312.76	15/16"	1329.38	15/16"	1345.99	15/16"	1362.61	15/16"	1379.23	15/16"	1395.84

[1]Based on a steel of 1 cu. in. = .2836 lb.

[2]Multiply constant by stock thickness in thousandths of an inch to get weight in pounds per thousand pieces

MODERN DESIGNS FOR DRILLING JIGS AND TAPPING FIXTURES

Tapping Nuts

There are several advantages when threading studs and tapping holes if the necessity for reversing the spindle to "back out" the threading tool can be avoided. Collapsible threading dies and taps which are standard tools can be used to eliminate this reversing. These tools reduce threading time to almost half and avoid injuring the threads which often happens if chips wedge behind the cutting edges when a reversing chuck is used. Unfortunately, collapsible taps and dies cannot be made for threading the smallest diameters, and the small numbered sizes of screw threads are those needed in the greatest quantities.

C. W. Hinman
Designing Engineer

There are two ways for tapping small nuts without either using collapsible tools or backing out the tap. In Fig. 173 the length of the tap shank is about ten times the diameter to be tapped. The shank diameter is .005" under that of the thread root thus clearing the tapped holes freely.

Nut blanks are moved under the tap in the slotted fixture *A*, which is placed on the drill press table. The slot acts as a wrench to prevent the nut from turning. The revolving tap is then lowered, cuts the thread through the nut, and the finished nuts are loaded up on its shank. When the top nut reaches the chuck, the tap is removed and the finished nuts are tipped off into a container; the tap is then replaced in the chuck. This method of tapping nuts produces good clean threads and the output per hour is fairly satisfactory. For tapping steel nuts which are larger than ¼-18, a roughing tap is used first and a finishing tap as a second operation.

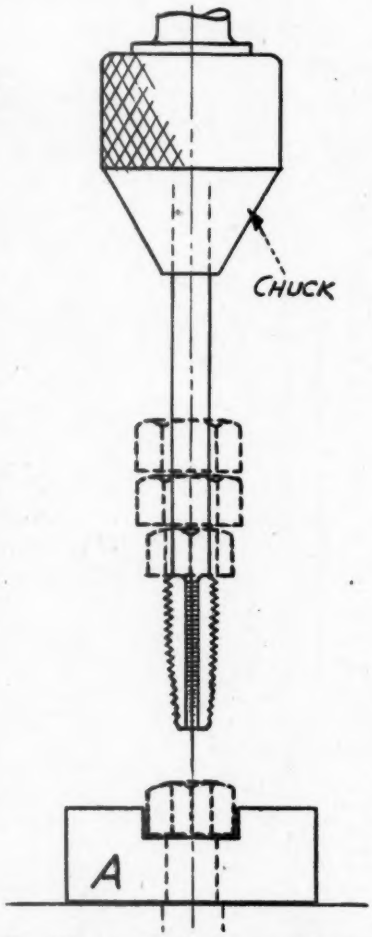


Fig. 173 — A tap having an extra long straight shank used for tapping nuts on a drill press without reversing the spindle.

Tapping Nuts With Bent Taps

Bent taps for threading small holes are commercially available. The bend

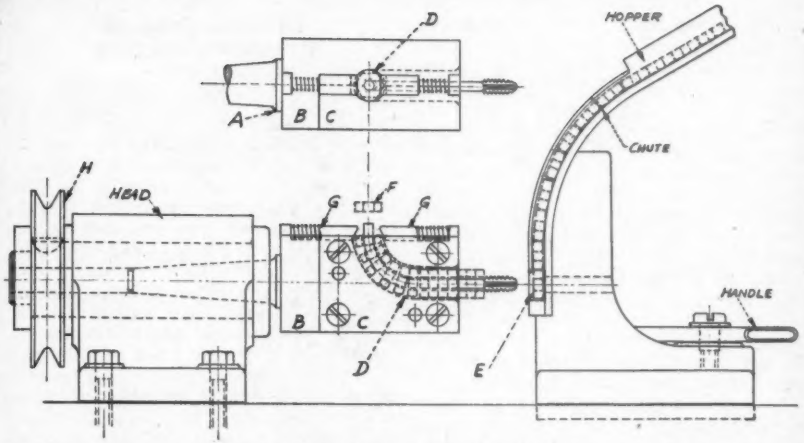


Fig. 174—A non-reversible horizontal tapping head, with a hopper, chute and bent tap holder, for high production threading of small nuts.

in the shank is a full turn of 90°. The shank diameter is .005" under that of the thread root and this provides clearance for the tapped nuts. In Fig. 174 a bent tap for threading small hexagonal nuts is shown mounted in tap holder *A*. This tap holder consists of two separate parts, *B* and *C*. A round clearance hole *D* has a diameter .010" greater than the maximum diameter of the hexagonal nut. The centerline of hole *D* coincides with that of the bent portion of the tap shank, and its longitudinal halves are worked out in blocks *B* and *C*.

Threaded nuts are loaded on the tap shank which causes it to "float" in its holder. The bend drives the tap when the holder revolves, and the hopper and chute are both operated horizontally by movements of the handle. Short quick movements of the handle, against positive stops, cause the blank nuts in the hopper to line up properly and to enter the chute and fall in line with the tap at position *E*. We are now ready to begin tapping the nuts in quantity production.

Each forward movement of the handle feeds a blank onto the tap and when a nut passes over the flutes on the tap it shoves the load of tapped nuts along the shank until one falls out at *F*. Two slider-bars *G*, actuated by light compression springs, frees one nut each time another is tapped. A metal band or guard, not shown, is positioned over the holder so that all the finished nuts fall out below.

The spindle and tap holder are driven by the pulley *H*. Two or three of these assemblies may be placed side by side in a multiple setup to increase the hourly output.

How to Avoid Tapping Troubles

When backing out taps from light pieces of work a stripper plate is necessary to prevent the work following up with the tap. When backing taps out of heavy pieces, a stripper plate is unnecessary because the weight of the piece holds it down. Heavy pieces having holes too close together, or production runs of too small an output requirement for using an expensive gang of multiple taps, present the problem of locating each hole directly under the tap. If the hole is not aligned properly with the tap, distorted threads and broken taps will result. This difficulty is also present when attempting to tap heavy pieces after a drilling operation by opening the jig leaf and then tapping, or by spotting, drilling and then tapping through the bushings.

Grinding taps properly is an art and, like grinding drills, it cannot be done freehand even by a professional toolmaker. By permitting inexperienced operators to hand grind small taps, one

manufacturer found that his monthly bill for new taps averaged about $175, but after installing a tap grinder, this cost was reduced about 60%.

For tapping blind holes, another manufacturer ground the ends of four-fluted taps square and then chamfered about one thread. The result was that the tap wedged a chip in the bottom of the hole and bound the tap tight. However, by using a three-fluted tap having right hand spiral flutes* and grinding the end to a 60° point, which chamfered about two threads, no further difficulties were encountered.

For tapping soft metals such as aluminum, magnesium, and zinc, the rake angle under the cutting lip should be 15° and the flutes must be polished smoothly. Polishing the flutes helps prevent chips from burning and adhering to the tap.

In small four-fluted taps, about 50% of the cross sectional area and strength is lost when cutting the flutes. The flutes are necessarily too shallow and chip spaces are insufficient; in operation the taps naturally clog with chips and soon break. Four-fluted small taps are therefore impracticable for machine tapping but are all right for the slower, more sensitive, hand tapping. It is always safer to use two- and three-fluted taps in the numbered sizes unless it's a case of a "through hole" having less than a 75% thread, and of a depth less than the tap diameter. Gun taps have spiral points for driving the chips forward. Lard oil, and its compounds, is the best lubricant for tapping metals, especially steel.

When tapping difficulties arise, do not attempt to force the tap because that cannot be done without inviting more trouble. First of all, stop the machine and examine the tap to determine if it is the right tool for the kind of material, whether it is ground properly for the material, and if the right lubricant is being used. Sometimes the trouble is that the machine is too light to drive the tap properly. If by a correction of these faults, you fail to have the successful tapping that you have a right to expect, contact the tap manufacturer, stating all the conditions, and follow his advice.

*See "Developments In Precision Tapping," *Tool & Die Journal*, May 1944, page 93.

Developments in Precision Tapping

(CONTINUED FROM PAGE 97)

etry of a tap point to determine the relationship that exists between chamfer eccentricity and symmetry. The end result would be the ability to introduce a predetermined chamfer eccentricity that in effect would equally oppose the already established over-size cutting action caused by the lack of chamfer symmetry.

The second factor to consider relative to a precision tap is the matter of spacing the flutes. Most manufacturers do index space the flutes when milling, but in the subsequent grinding operation simply follow the "as milled" flute. Now, due to scale and warping resulting from the hardening operations, and also to lack of proper upkeep of the miller indexing head, the flutes will vary as much as .008" in spacing. On some ¼-18 No. 2 precision ground taps, we found that although they measured the same on pitch diameter, they varied in the size to which they cut by about .0015". A thorough inspection of the taps was made and the only differences were in the flute spacing. We then reground the flutes so that they indexed within .001" and all of the taps then cut to the same size.

Most tap manufacturers are now aware of this condition and are doing all that they can under present conditions to overcome it and still maintain their production.

Where he requires extreme accuracy, a buyer should specify that his taps be precision fluted.

In my next discussion, I will attempt to tell just what tap to specify in order to get the best results as to size and tap life.

Plastics Reprint

"Brief Survey of Plastics", a 36-page reprint of Mr. Prince's first five articles (February, March, April, May and June issues) is now available for distribution. The reprint is in answer to a considerable demand from our readers. Individual copies are 25 cents each, with discounts allowed on quantities. Send orders to the Tool & Die Journal, 2460 Fairmount Blvd., Cleveland 6, Ohio.

COMPREG DRILL FIXTURES

SPEED SMALL PARTS ASSEMBLIES

Harry W. Tompkins
CURTISS-WRIGHT CORPORATION
Buffalo, New York

Completely revising the former conception of drilling fixtures for small parts and sub-assemblies, compreg wood tooling is showing outstanding savings at the Buffalo Plants of the Curtiss-Wright Corporation.

The application, originally suggested by Irving Schultz of Tool Development and developed in conjunction with Harold L. Hanna of the Planning Department, has reached a stage of perfection where these new production tools are making possible volume output by drilling small parts *in sets* with accuracy and speed which greatly surpasses previous standard metal tooling.

The vast war tooling programs which caused accepted metals to be allocated where most urgently needed, started metallurgists, chemists and research men on a quest for substitutes which would augment the vanishing supply of these tool steels. "Compreg" wood, used in these drill fixtures, is a war-born idea but current developments and performance figures indicate that it will continue in use even when steels are again available.

The name "Compreg" is descriptive of the product for it is a combination of synthetic resin and wood with the original identity of the two materials being merged in the resulting product. Thin layers of wood are thoroughly impregnated with the phenolic resin; laminated in a varying number of layers, depending on the application, and the whole compressed under 1600 psi hydraulic pressure which is maintained during the curing process. The resulting product has a high strength-weight ratio and is practically impervious to moisture, oil,

This complete drill and assembly fixture drills 48 holes. A locking cam clamp securely locks the parts, resulting in perfect alignment of all parts, also locating pulleys in proper position. Parts are easily removed by hand ejectors.

A box drill jig for four parts (two sets). Drills for pulley brackets—SS pins, and all flanges for riveting. A previous steel fixture drilled only one part (two fixtures needed for one set) for pulley and SS pins. The fixture can be used on a drill press.

Drill fixture for drilling four pieces including one extrusion. A former steel fixture weighed 60 pounds; this fixture weighes 10¾ pounds. A steel separator plate is used to allow for plate and rivet clearance on partially assembled parts. Holes are to reduce weight.

A box drill jig. Holds four pulleys, two large and two small. It is similar to the jig shown below.

A box drill jig for complete assembly of three parts including part of an angle extrusion. Parts are easily inserted and held in position with bullet catches. When the lid opens, parts are ejected automatically.

This pulley bracket drill fixture is designed for two difficult, irregular shaped parts. The fixture consists of a bed plate, spacing plate and pressure plate. It is used to drill seven holes. The spacing plate incorporates a spring positioning device. The fixture is designed for use on a drill press.

alcohol, mild acids and alkalies. By weight comparison it is approximately one-sixth that of steel and one-half that of aluminum.

The Compreg process was originally developed in the U. S. Forest Products Laboratory. The Curtiss-Wright Research Division has conducted experiments with various grades of wood and types of resin in an effort to obtain specific qualities. Compreg obtained from commercial manufacturers is also being used in increasing quantities.

One of the outstanding features of Compreg is the ease with which it may be worked. Standard wood working tools, familiar to the pattern maker, meet all requirements since it can easily be sawed, jointed, routed, shaped and drilled. Obviously, the conventional tool maker is released for the more difficult types of jigs and fixtures which requires the use of steel, since much of the work is performed by pattern makers. However, the services of the tool maker are required for providing the internal ejecting levers and the interesting clamping and latching devices.

Drill bushings and locating pins requiring a press fit are easily inserted, while hinges, bearing plates and other metal parts can be bolted by drilling and tapping. Compreg is readily tapped and the resulting threads are strong and perfect.

When the qualities of this new material were understood, it was apparent that here was a material which was not a substitute but rather one which had such possibilities that an entirely new concept was required. The objective of the small assemblies retooling program was to discard all the accepted standards and try to provide in one fixture, the means of holding *all parts* of the small assemblies, such as pulley fixtures, many of which are irregular in shape.

An acknowledged success from the first, these new Compreg fixtures are piling up savings both in tooling costs and production plus a bonus of more accurate work.

Old tool makers may raise an eyebrow at these statements but figures obtained from the labor measurement group show increases in production varying from 100 percent to a present top of 500 percent! And it is accurate production since all parts are accurately positioned by spring bullet catches, and

are held in positive alignment by spacing plates, the pressure being developed in latching the cover. After the drilling operation, the simple opening of the cover actuates the ejecting mechanism which raises all parts of the assembly so they may be grasped and removed without the aid of tools.

Much of the accuracy of these Compreg fixtures comes from the manner in which they are made. Copy templates, made from loft master templates, are doweled to the material for dimensional locations which insures accurate location of the holes to be drilled.

Changes in the fixtures may be easily made. Drill bushings can be removed, the old holes filled with a plastics material and when hard, the new locations are established. This feature, plus the greatly reduced first cost, gives flexibility to a tooling program and yet the tooling is sufficiently permanent to handle a large contract.

Although light in weight, Compreg has excellent physical properties. It has a tensile strength of 45,000 psi, a compressive strength of 35,000 psi and a bending moment comparable to steel. It is very stable with virtually no dimensional change resulting from moisture or temperature changes under ordinary shop conditions. Its hard, lustrous finish requires no other surface protection and it will not scratch or mar aluminum parts worked over it.

Job instruction is simplified for it has been conclusively proven that semi-skilled and even untrained workers easily grasp the operation and produce accurate work once the loading of the fixture is understood. There are no thumb screws or pins used for locking parts in position and since the fixture is all in one unit, parts cannot be lost as in the case of many conventional steel fixtures used for this purpose.

The application of these Compreg fixtures is a virgin field and with the increasing number of applications, those in charge of the re-tooling program for these small assemblies are becoming bolder with each new success. Assemblies which have previously presented complex tooling problems are now accepted as "routine" and shortly make their appearance on the drilling tables to speed the output of the productive departments of Curtiss-Wright.

Materials Weight Tables

(*See Pages 98, 99, 100 and 101*)

We regret that this month's space budget limits us to this brief instructional note. For more detailed examples see the Tool & Die Journal, May 1944, page 94 and June 1944, page 97. The Materials Weight Tables permit a quick determination of the weight of stock required for a given press run. For example, to calculate a job that is to be blanked out of steel strip 7" wide, .033" thick, and of a "pitch", or length of stock feed per blank, of $5\frac{1}{16}$": In the $5\frac{1}{16}$" column we find the constant 5742.90 opposite 4". Multiplying this constant by the thickness in thousandths, or, 5942.90 x .033 gives 189.5157, or 190, as the weight in pounds of 1000 pieces 4" x $5\frac{1}{16}$" x .033". Moving the decimal place three places to the left gives the weight of a single piece; multiplying the weight in steel by the appropriate conversion factor gives the weight in other materials.

Tobin Bronze = weight in steel x 1.065
Zinc, rolled = weight in steel x .916
Magnesium = weight in steel x .222

Double Purpose Dressing Tool

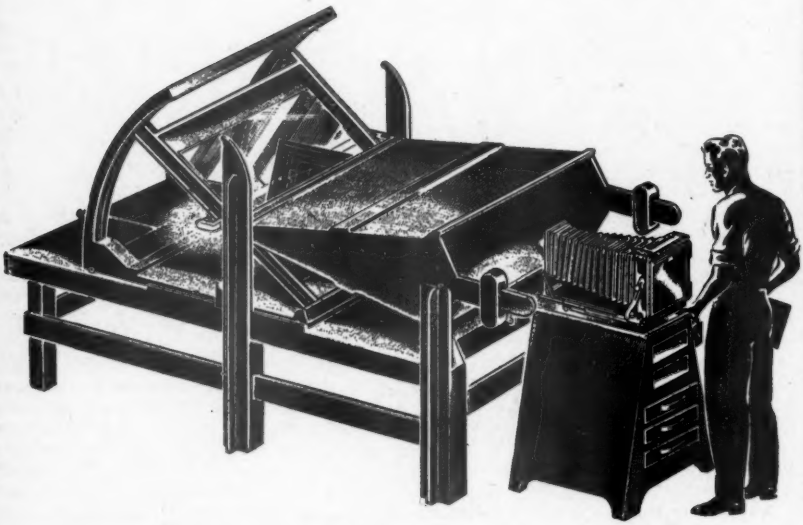
Welcome news to production men, tool supervisors and grinder operators alike is an announcement of a most practical double purpose diamond dresser tool which has recently been put in production by the Diamond Tool Co. This new tool, designated the "Handl-Nib", is made up of an ejector type handle and a securely held "Big-Hed" diamond nib. When it is used as a hand tool, the "Handl-Nib", supported by the grinder steady rest, is drawn across the face of the wheel. By combining a rolling action with the correct angle of inclination, one pass of the tool produces a good dress. For machine dressing, it is only necessary to press down on the handle ejector rod in order to release the nib for use in the adaptor of a Norton center grinder or any other machine taking a $\frac{7}{16}$" shank nib. Return to use as a hand tool is effected simply by pressing the nib back into the handle socket. The new "Handl-Nib" dresser is available with resetable nibs containing diamonds of 2 carats and larger. Detailed information may be secured from the Diamond Tool Co., Dept. TD, 951 E. 41st St., Chicago 15, Ill. 633-M

THE MARTIN AXONOGRAPH

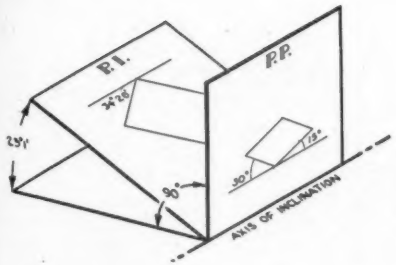
as developed by

W. G. Wilkinson and H. C. Bartholomew

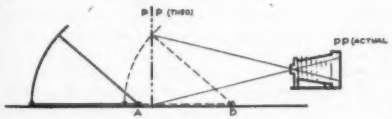
Engineering Department, THE GLENN L. MARTIN COMPANY



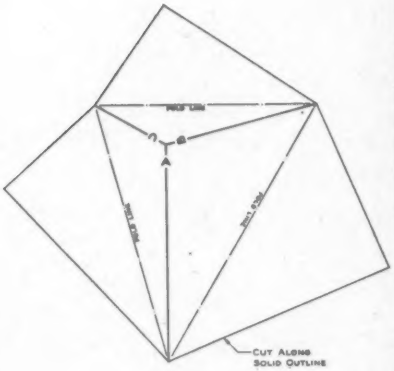
The trimetric drawing is a type of three dimensional drawing that has long been recognized as an ideal form of product and assembly illustration. It has seldom been used heretofore because of the geometrical difficulties and time involved in its preparation. A series of radically new and ingenious developments by W. G. Wilkinson and H. C. Bartholomew of the Engineering Department of The Glenn L. Martin Company has overcome these handicaps. The developments are embodied in a new machine, known as the Martin Axonograph, illustrated above, and its accessory equipment. The combined result is that the making of a trimetric drawing or Axonograph print becomes a mechanical operation of mathematical accuracy and at a saving in time of from 50 to 80 per cent. Essentially, the machine consists of an optical projection set-up for photographically translating a conventional orthographic drawing into a scale representation of one face or dimension of a trimetric projection. There is a copy board that is adjustable as to its angle from the vertical. The copy board incorporates a rotatable stage to which is secured the orthographic drawing, thus, the stage permits rotating the drawing in the plane of the copy board. The copy board assembly travels on a horizontal track and is motor driven. As the copy board moves toward or away from the camera, a fulcrumed funnel, the small end of which is in intimate contact with the copy board, rises or falls. Across the small end of the funnel is a narrow, transverse slit, and, behind the drawing and traveling with the funnel member is a tubular light source which, thereby, is always opposite the funnel slit. The funnel fulcrum rolls sufficiently so that the combination of the copy board horizontal motion and the sweep of the funnel results in the slit "scanning" or intersecting the drawing throughout a vertical plane parallel to the camera image plane.



Illustrated above is the positioning of the orthographic drawing in relation to the vertical. This represents the inclined copy board and the angular placement of the drawing on the copy board stage. The vertical plane represents the object plane or film or paper plane of the camera component of the Axonograph. The plane in which the print is to be made is determined by the nature of the part and its position in relation to the position of the finished drawing. Thus, in the case of a fuselage, if the finished trimetric projection is to show it in a position corresponding to a three-quarter rear view, Axonometric prints of the bulkheads would be made in the face plane, but prints of a top hatch would be made in the plan plane, while those of a side hatch would be made in the side plane.

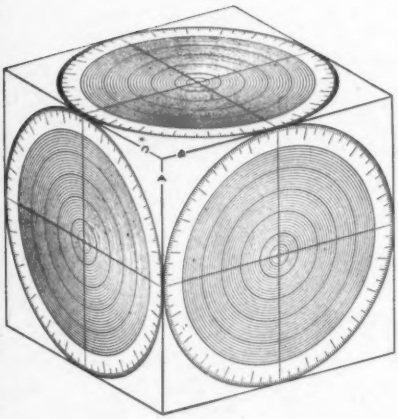


In the above diagrams of photo-axonometric projection, PI represents the adjustable copy board which travels forward through a theoretical PP. As PI moves through PP from A to B, the scanning funnel with its transverse slit and corresponding tubular light source permits the camera to record *only* the line of intersection of the two planes. In other words, if the camera were equipped with a between-the-lens shutter it would be kept open as for a time exposure; the actual exposure would be effected by the sweeping or scanning funnel slit. To employ still further conventional camera terminology, Messrs. Wilkinson and Bartholomew have evolved the exact opposite to a conventional focal (or image) plane shutter, i. e., an object plane shutter!

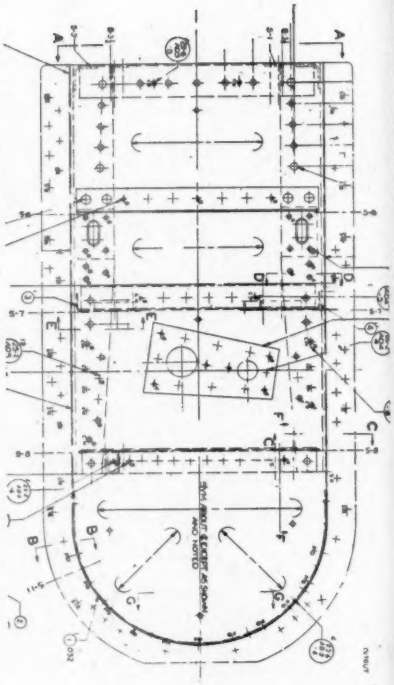


Axonometric projection is a form of orthographic projection in which an object is situated with its three principal faces inclined to the picture plane so that the three faces are represented in one view. Since a cube can be placed at an infinite number of inclinations to the picture plane, it can have an infinite number of axonometric projections. The three edges of the cube which meet at the nearest corner are known as the coordinate axes. These edges, being inclined to the picture plane, become foreshortened. Trimetric projection is the case of axonometric projection in which the three coordinate axes are foreshortened unequally. The directions of the three projected axes may be optional, provided that the three angles formed by them are each greater than 90° and that no two angles are equal. The choice of one projected axis in a vertical direction, with the other two axes at angles of 105° and 120° to the vertical, establishes the cube in the most advantageous trimetric position.

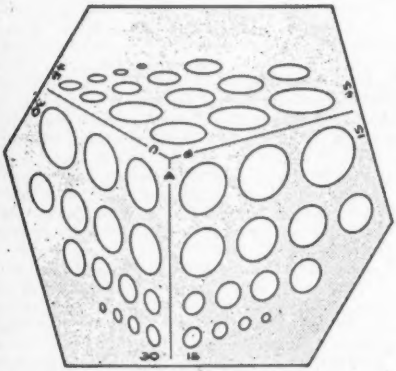
A striking demonstration can be made from the above figure. Make a tracing of it and cut out along the outermost triangles. Crease sharply along the fold lines and with the fingers of the two hands, held at eye-level, fold the outermost triangles forward to form the corner of a cube. Sighting with one eye, when you can just see the drawn edges of the cube corner through the intersections of the folded triangles, you are holding the cube corner in the position from which it was projected for drawing trimetrically. This shows that the vertically projected axis is actually inclined forward at an appreciable angle.



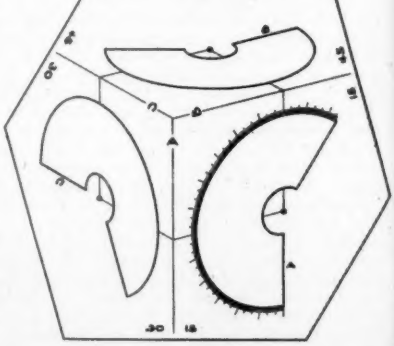
Correlative with the development of photo-axonometric projection a system of axonometric drawing has been perfected for the rapid and accurate construction of trimetric illustrations. This involves precision instruments for the illustrator, corresponding to the draftsman's scale, circle template and protractor. Illustrated above is the Trimetric Underlay. For ellipses larger than 1" this is placed under the drawing for tracing the desired ellipse.

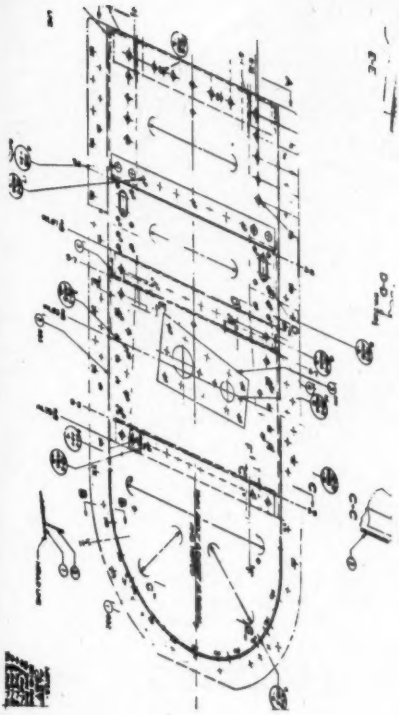


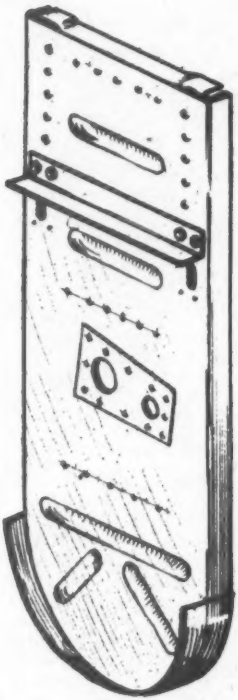
The basic design of the trimetric protractor, below, is similar to the ellipse template. For any one of the trimetric positions the protractor is used for the corresponding angular measurement.



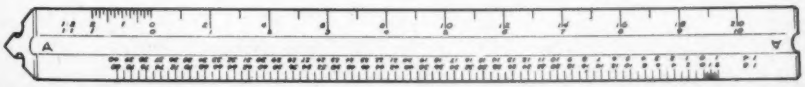
The Trimetric Template provides three series of ellipses, one for each of the three principal faces of the trimetric cube. The fifteen ellipses in each series are in the sizes from 1/8 of an inch to 1 inch in 1/16 inch increments. All ellipses in any one axonometric plane have the same proportion of Major to Minor Axis.







The upper right illustration on page 112 is from a standard orthographic print of an A-30 Baltimore bulkhead and is as it appears on the loft template. It is a negative of this ortho print that is placed on the stage of the inclined copy board of the Axonograph. Following the positioning of the negative, the camera is loaded with ordinary photographic printing paper and the machine is set in operation. The exposure is made as the funnel scans the entire drawing and thus records the axonometric projection on the sensitized paper, which is then developed in the same manner as an ordinary photograph. Thus is attained an axonometric projection of the same bulkhead as is shown in the illustration above, left. This axonograph print is then returned to the drafting room where it is positioned in its proper place in the trimetric drawing lay-out and it is then traced. All that then remains for the draftsman is to fill in the other two planes and any connecting members for which no prints have been made. These final manipulations are expedited and executed with mathematical accuracy by means of the Trimetric Scale, Template, Protractor and Underlay. Above, right, is shown the finished Trimetric print of the aircraft fuselage bulkhead.



The Trimetric Scale has an "A" face, a "B" face and a "C" face, each graduated 1:1, 1:2, 1:4 and 1:8 for the majority of measurements on the A, B and C Axes.

Write for New Low Prices

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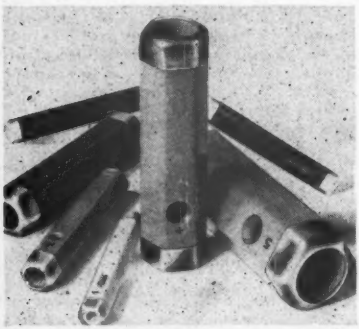

Federal Taperlock Plastic Gage Handles have proved very satisfactory for glass gages. Being so much lighter than metal handles the danger of chipping and breaking is greatly reduced.

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INDUSTRIAL PLASTICS

Procedures in Plastics

PHYSICAL PROPERTIES EXPLAINED

By Warren V. Prince

Before discussing the various types of plastics materials in detail, we should gain a thorough understanding of the meaning of the various physical properties and their methods of measurement. Plastics materials are usually compared in terms of these physical properties.

Following is a list of the most important physical properties which require explanation:

Mold shrinkage
Compression ratio or "bulk factor"
Specific gravity
Specific volume
Tensile strength
Compressive strength
Flexural strength
Impact strength
Modulus of elasticity
Elongation
Hardness, Brinell
Hardness, Rockwell
Distortion under heat
Softening point
Resistance to heat
Thermal conductivity
Specific heat
Thermal expansion
Dielectric strength
Dielectric constant
Volume resistivity
Power factor
Moisture absorption
Cold flow
Refractive index

Other physical properties are of such a simple nature or are used in the commonly accepted meanings of ordinary speech so that explanations are not required.

The proper selection of a plastics material for any given application requires, first of all, a careful analysis of physical properties of each material.

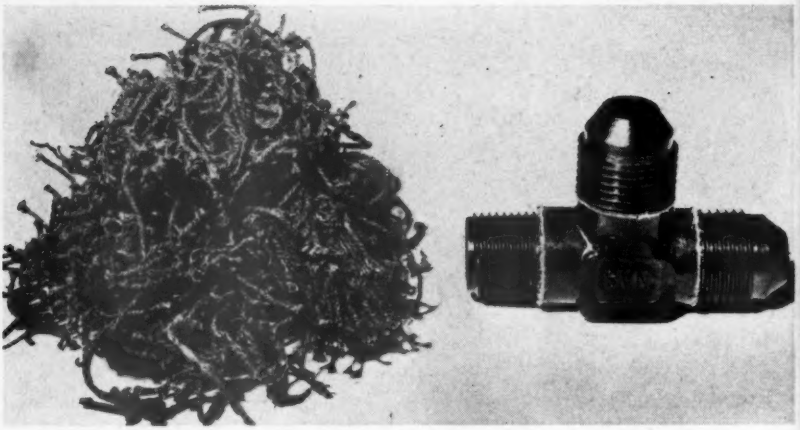
For an approximate comparison of physical properties, the best available charted data is published annually by the Plastics Catalog Corporation.[1] A practical booklet for beginners is available from the Boonton Molding Company.[2] For more detailed charts, the handbook "Technical Data on Plastic Materials" published by Plastics Materials Manufacturers' Association[3] should be consulted.

Before making the cavity of the mold or molding the plastics parts, it is wise to obtain the physical property data sheet from the material supplier for the particular material to be used in the mold. Take advantage of the advice and services of your local materials representative before proceeding too far with production plans. With new and improved materials, supply and re-

[1]Published in the "Plastics Catalog" or available as a separate chart ($1.00) 122 East 42nd St., New York 17, N. Y.

[2]"A Ready Reference for Plastics," published by Boonton Molding Co., Boonton, N. J. Copies at 75 cents or on requests on company letterhead.

[3]Address 631 Tower Bldg., 14th & K Sts., Washington, D. C. Copies are $1.50 each.



A cord filled phenolic material with a large bulk factor 2.5-15 to 1.

stricted materials changing rapidly, such contacts are well worth cultivating.

The standard procedures for most of the physical properties are outlined in detail in the "A.S.T.M. Standards on Plastics" (commonly referred to as "D-20" after a committee) published by the American Society for Testing Materials.[4] Wherever possible, all testing of plastics should be done in accordance with these standards.

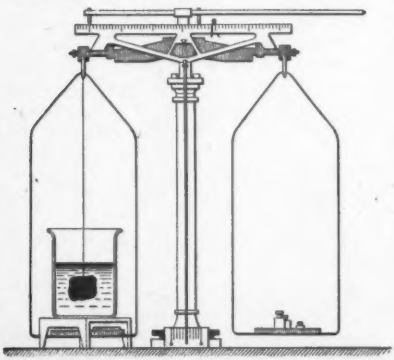
Mold Shrinkage

All plastics materials shrink upon cooling from molding temperature to room temperature. Polymerization also causes a slight shrinkage, but much less than the shrinkage due to temperature drop. These shrinkages vary from .001 to .030 of an inch per inch, depending upon the material. The average shrinkage for general purpose phenolics varies from .006 and .008 and the average injection molded cellulose thermoplastic material varies between .002 and .003 inch per inch.

For example, by .007 "inch per inch" we mean that for every inch of length of plastics material the material will shrink .007 inch. If the part is 3.000 inches long, the shrinkage is 3.000 x .007 or .021 inch total, and the mold must be made 3.021 inches long in the cavity in order to compensate for the shrinkage. However, it is better to allow a little under .021 for shrinkage for reasons to be explained later in more detail.

Thermal contraction is only part of mold shrinkage, however. The remainder is due to chemical changes that occur with heat, such as dehydration, volatilization of plasticizers, and even further polymerization.

The balance scale used for determining specific gravity. (From ASTM Standards on Plastics)



Compression Ratio or "Bulk Factor"

Compression ratio is more commonly called "bulk factor" among molders. It is the ratio of the volume of the loose molding powder to the volume of the molded article made from it.

[4]American Society of Testing Materials, 260 South Broad St., Philadelphia, Pa. Copies are $2.00 each.

General purpose phenolics have a bulk factor of from 2 to 3, depending upon the proportional volume of its filler. High impact materials which contain such fillers as rags, for example, have a bulk factor as high as 15. The bulk factor of thermoplastic materials is usually less than that of thermosetting materials and averages between 1½ and 3.

In compression molding sufficient space must be allowed above the cavity to hold the bulky molding compound required for each piece. If insufficient space is allowed, preforming can usually solve the problem by compressing the material into a pellet or tablet prior to molding, in order to reduce bulk factor. Thermoplastic materials cannot be readily preformed.

Specific Gravity

Specific gravity is the *ratio* of the weight of the molded piece to the weight of an equal volume of water. The specific gravity of water is 1. The weights of all other materials are expressed as a ratio to the weight of water.

Since all molded plastics are heavier than water, their specific gravity may be measured by immersing the piece in water. The procedure is to suspend such an immersed piece with a fine wire or thread of negligible weight and measure the weight required to suspend the molded piece in the water. This is done with a balance scale. The following formula is used for computing the specific gravity:

$$\text{Sp. Gr.} = \frac{\text{Wt. of piece in air}}{\text{Wt. of piece in air} - \text{Wt. of piece immersed}}$$

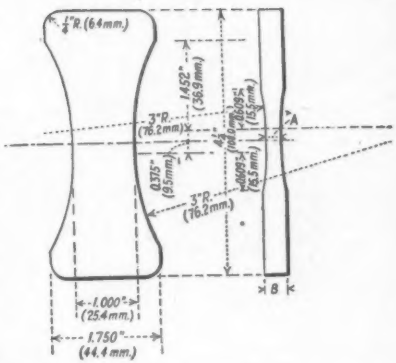
Specific gravity is used: (1) to estimate the weight of a material required for a molded piece; (2) as a comparison between weights of materials; and (3) to measure and determine the "density" of a molded piece as compared with a designed or normal density.

One cubic inch of water weights .0361 pound, 16.4 grams or .578 ounces. In estimating the weight in pounds of a plastics piece, use the following formula:

Wt. of piece in pounds = .0361 x specific gravity x cubic inches of volume in the piece

Wt. of piece in grams = 16.4 x specific gravity x cubic inches

Wt. of piece in ounces = .578 x specific gravity x cubic inches



The standard "dog bone" design for testing for tensile strength. (From ASTM Standards on Plastics)

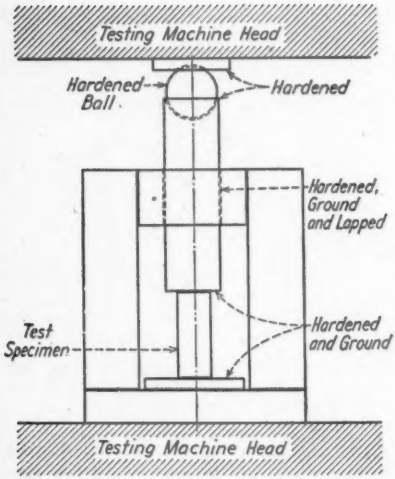
Tinius Olsen machine for testing tensile and flexural strength of plastics materials. Photo courtesy United States Testing Co.

Specific Volume

Specific volume is cubic inches per pound. It is given as the volume of molded material in cubic inches for the weight of one pound of that material. Specific volume is used chiefly for study of comparisons between plastics materials or plastics with other materials.

Tensile Strength

Tensile strength is "pull". It is meas-



The standard compressive set-up. The cross-sectional dimensions are to the nearest .001", the length to .01", the rate of head travel is not greater than .05" per min. for both the load-deformation and maximum load determination. (From ASTM Standards on Plastics)

ured as pounds per square inch and expressed as a stress in pounds per square inch (psi). It is calculated by dividing the maximum load in pounds that a material can withstand before breaking by the square inches of cross section area of the piece. The cross section must be measured at right angles to the direction of the pull and be taken at the narrowest portion of the piece. Note that pounds *per* square inch means pounds *divided by* square inches.

In standard tests a "dogbone" shaped sample of molded material is used. The large ends are used for grasping the piece without damaging it during the test. It is used to determine the load limit that a piece can withstand before pulling apart. It is expressed as pounds per square inch of cross section.

Tensile Strength =

$$\frac{\text{Pounds required to pull apart}}{\text{Sq. in. of cross section area}}$$

Compressive Strength

Compressive strength is the number of pounds that one square inch section of a plastics piece can withstand before rupture occurs. Like tensile strength, it is measured and expressed as pounds per square inch, i. e., pounds required to crush divided by square inches of cross section area taken at right angles to the compressive force.

Compressive Strength =

$$\frac{\text{Pounds required to crush}}{\text{Sq. in. of cross section area}}$$

Flexural Strength

Flexural strength represents resistance to breaking when subjected to a bending force. Do not confuse this with rigidity. A simple way to test flexural strength is as follows: a standard test bar, usually ½ x ½ x 5 inches long is supported at two points (e. g. 4 inches apart); a force is applied from above, midway between the points of support, and increased until rupture occurs. The following formula is used:

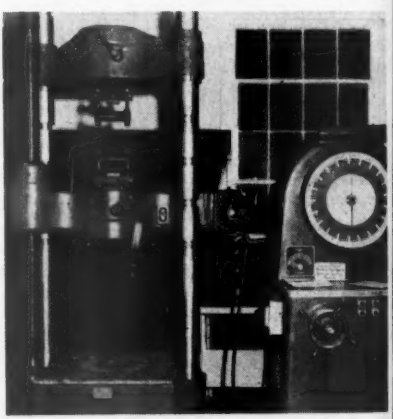
Flexural Strength =

$$\frac{3FD}{2WT^2}$$

Where:

F = the Force applied

D = Distance between points of support



Baldwin & Southwark 200,000 lb. universal testing machine used to determine tensile and compressive strength of plastics materials. Photo courtesy United States Testing Co.

W = Width of specimen tested

T = Thickness of bar in direction of bending

For sheet materials, the points of sup-

port must be moved closer together due to flexibility.

Impact Strength

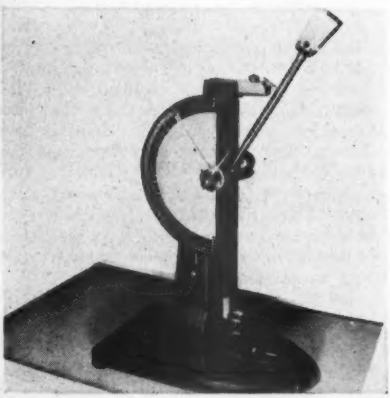
Impact strength is toughness or shock resistance. It is measured by a sudden blow upon the sample test bar. A pendulum hammer is used to deliver the blow.

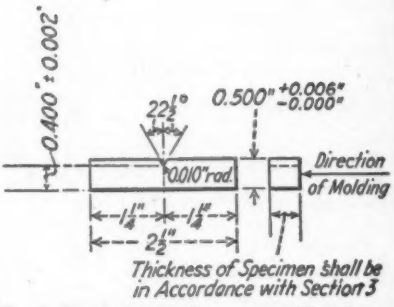
There are two methods of testing impact strength. The Izod test (cantilever beam) holds the test bar (½ x ½ x 5 inches long) at one end and the blow is struck upon the other end. The Charpy test (simple beam) supports the bar freely at both ends and the blow is struck in the middle. The Izod test is more commonly used.

In both cases the bar specimen is machine notched to remove the hardened "skin" influence. The pendulum head strikes the bar on the bottom of its swing and the distance of the up swing is measured in comparison with the same up swing with a free path. In this way the energy in foot pounds can be read on the dial at the end of the up stroke after breakage. The tougher the bar, the more energy is absorbed in breaking and less is the distance of the up stroke.

Impact strength is usually expressed in foot pounds per square inch of notch, which is the standard form of expression. Be on the alert for other forms of expression such as "energy to break"

Izod impact tester (cantilever beam) to determine the impact strength of plastics materials. Photo courtesy United States Testing Co.





Izod impact specimen specifications. (From ASTM Standards on Plastics)

in foot pounds; this is always equal to one-half of the value in foot pounds per inch of notch. The reason is that the standard test bar is one-half inch in section. Another expression is foot pounds "per inch square"; this is about 6¼ times as much as foot pounds per inch of notch. Sometimes bars are tested without being notched; this will show higher values and will depend more upon cure than upon other material characteristics.

Modulus of Elasticity

Elasticity is the tendency of a body to return to its original shape after being deformed. Modulus of elasticity applies only within the elastic limit of any given material. It is the stress in pounds per square inch developed in the material due to deformation divided by the deformation in inches. In short, it is stress divided by movement.

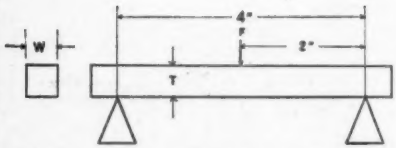
Thus, we see that a material of low *modulus* of elasticity has the highest *elasticity* or resiliency and that a high modulus indicates low resiliency.

In plastics, the modulus of elasticity is usually given in tension or pull and specified as pounds per square inch x 10^5. The "10^5" means that the decimal point is moved five places to the right to get the true numerical value.

An easily computed test is modulus of elasticity in bending. This uses the standard ½ x ½ x 5-inch bar mounted in the same way as for the flexural test. A record is kept of the loads and deflections. The following formula is used for determining the modulus of elasticity:

Modulus of Elasticity =

$$\frac{(P_1-P_2)\,L^3}{4WT^3(f_1-f_2)}$$



This standard test set-up is used for determining flexural test, modulus elasticity and distortion under heat.

Where:

P_1 = Pounds load at beginning of deflection

P_2 = Pounds load at elastic limit

L = Lenth of bar (in this case 5)

f_1 = deflection at load P_1

f_2 = deflection at load P_2

W = Width of bar

T = Thickness or depth of bar in direction of bending

Bear in mind that this test must be made in such a way that the maximum deflection never exceeds the elastic limit, so that the test piece can return to its original position after maximum load is released.

Elongation

Elongation tells how far a specimen can be pulled apart before it breaks. It is given as a *percentage* of its original length that it can stretch before rupture occurs. For example, if a one inch piece of celluloid stretches to 1½ inches before rupture, the elongation percentage is equal to 50. The elongation percentage for general purpose phenolic plastics is only .6, or less than one percent.

Hardness (Brinell)

The Brinell method of testing the hardness of a plastics part is determined by pressing a steel ball into the test surface with a known force and measuring the area of the indentation. The harder the material, the smaller the indentation and the higher the numerical value.

The most common setup is to use a 1 cm. ball and a force of either 500 kg. or 3000 kg. load or to use a 25 mm. ball and 25 kg. load. The hardness rating is established for each method by dividing the load applied by the area of the surface of indentation and is expressed as kg. per sq. mm. Special machines are used for the test.

Hardness (Rockwell)

The Rockwell method of testing hardness uses a penetrator which is forced into the surface; the depth of penetration is recorded to establish the hardness of the surface.

The penetrator is a steel ball of from ⅛ to ½ inch and is forced into the surface by a gradually increased load, taking approximately 6 to 8 seconds to apply. A special machine is required for this testing. The greater the hardness, the higher the Rockwell reading.

Distortion Under Heat

Distortion under heat is the temperature at which a given load will deflect a standard test bar a given distance as a result of the material being softened by heat.

A load of 5½ pounds is applied to a standard test bar (½ x ½ x 5 inches) at the middle of the bar when it is supported at two points 4 inches apart. The test is setup in the same way as for the flexural test and the modulus of electricity test.

The heat is then gradually raised until the bar deflects .010 (ten thousandths) inch as a result of the increase in heat. This is called the heat distortion point and is usually given in degrees Fahrenheit. It indicates what can be expected of a plastics part assembled under a moderate load.

Softening Point

Softening point is the temperature at which a plastics part becomes readily distorted from a very light load. This point is usually higher than the heat distortion point because the load is less. The nature of the test determines the loads to be applied. Sometimes the test is made by raising the temperature until the plastics part softens sufficiently to show distortion under its own weight.

Most of the thermosetting materials have no softening point.

Resistance to Heat

Resistance to heat is the temperature at which the plastics piece will be permanently damaged by continuous heat.

The result may be softening from heat, as with most thermoplastic materials. The piece may lose strength, begin to disintegrate, or ultimately burn if the temperature becomes high enough. The latter is true with most thermosetting materials. Heat resistance tests are made with no load or forces applied. The test is for temperature alone.

Thermal Conductivity

Thermal conductivity is the time *rate* of transfer of heat through a material. Copper, for example, conducts heat rapidly; plastics materials have an average of about 1/1000 as fast. Steel conducts heat about $\frac{1}{10}$ as rapidly as copper; plastics materials conduct heat about 1/100 as rapidly as steel.

A better definition of thermal conductivity is the time rate of transfer of heat by conduction through a unit thickness, across a unit area for a unit difference in temperature.

Specific Heat

Specific heat, similarly to specific gravity, uses water as the standard of comparison. In this case, specific heat is the *ratio* of the thermal capacity of a substance compared to that of water at 15° C or 59° F.

The specific heat of water is equal to one (one calorie to raise one gram of water one degree Centigrade).

Thermal Expansion

Sometimes called thermal expansivity, this is the coefficient of expansion, which is the increase in length per unit length per degree Centigrade rise in temperature.

Thermal expansion runs much higher in plastics than in metals. For example, it ranges between 3½ and 35 times as much as steel, depending upon the plastics material.

For plastics the values are usually given in inches x 10^{-5} per degree Centigrade for one inch of material length. By "10^{-5}" is meant that the decimal point is moved five places to the left. This value in inches represents the expansion (or contraction) per degree Centigrade for each inch of material.

Dielectric Strength

Dielectric strength is the voltage that will rupture or puncture a thin sheet of the plastics material when placed between electrodes of a given size.

Since plastics are very poor conductors of electricity, they make good insulators or dielectrics and generally withstand high voltages.

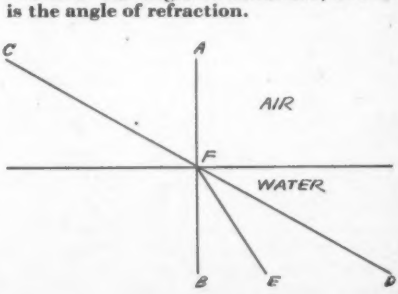
The dielectric strength is specified as volts per mil (one mil is one thousandth of an inch) and 60 cycles is taken as the standard alternating current. Higher frequencies give different results. Thickness of the material also changes the values, since thin insulation will stand more volts per mil than will thick insulation.

Test specimens are usually from ⅛ to ¼ inch thick. These tests are used principally for a comparative basis between materials rather than for design data. This is true because of the differences between test and application conditions.

Dielectric Constant

When two conductors such as metal are separated by an insulator such as air or a plastics material, they form a condenser. Condensers are rated electrically in terms of capacity. The dielectric constant of any material is the *ratio* of its capacity (when used with a condenser) as compared with the capacity of air used with the same condenser. Air is taken as the standard and all other materials are in comparison. The better the insulator, the higher the dielectric constant.

Angles of incidence and refraction. Ray of light C-D in straight line; refracted ray C-F-E. A-B is perpendicular to the surface of the water (or other medium); C-F-A is the angle of incidence; E-F-B is the angle of refraction.



Volume Resistivity

This is sometimes called resistivity and represents the leakage which occurs in insulating materials. It is measured on ohms of resistance between the opposite faces of a one centimeter cube of the material. The ohm is the standard electrical unit of resistance. It is the resistance when a pressure of one volt forces a current of one ampere through a wire. This may be compared to the manner in which friction retards the flow of water in pipes.

Copper offers very little resistance to the flow of electricity but plastics offer extremely high resistance.

Power Factor

Power factor is the *percentage* of leakage or losses of electric power, particularly at high frequencies such as employed in radio circuits. The leakage of power occurs through even the best of insulating materials.

What happens is that in alternating current circuits the insulating materials cause a lag in the cycles of current to exist in the presence of cycles without lag. This prevents the pulsations of the alternating current from developing to a maximum and energy is lost. This energy is known as power loss and the percentage loss is the power factor.

The lower the power factor the better the material for electrical purposes. Usually the higher the frequency, the greater the power losses.

Moisture Absorption

Moisture absorption is given as the *percentage* of water absorbed by a sample immersed in water. It is sometimes called water absorption and is rated in terms of the length of time of immersion. Since the area of the surface exposed to the water is important as compared to the weight of the piece, standardized shapes and sizes must be used.

The standard test procedure for molded plastics is done with a sample 2 inches in diameter by ⅛ inch thick. The specimen is first dried for 24 hours at 122° F (50° C), then cooled in a desiccator and weighed on a chemical balance. The sample piece is then immersed in water at room temperature for 24 hours, removed, wiped off and weighed again. This weight includes the water absorbed. The difference in weight represents the percentage of water absorption.

This data is used for such design considerations as electrical and mechanical properties, dimensions, appearance and dehydration effects.

Cold Flow

Cold flow is the distortion in the material which takes place under a constantly applied load at room temperature. This distortion is permanent and is not to be confused with elasticity.

The standard test is made by loading a ½-inch cube of material with a 1000 pound weight and, after 24 hours, measuring the *percentage* which the height of the cube was reduced.

Cold flow is common with thermoplastic materials. It is especially pronounced when the plastics part is fastened together with rivets or threaded means where considerable strain exists. Cold flow is sometimes referred to as "flow" when it takes place at high temperatures.

Refractive Index

Refractive index or index of refraction, a term used in the field of optics, tells how much the light rays are bent in passing through a transparent material.

In measurement the refractive index is the *ratio* of the sine of the angle of incidence to the sine of the angle of refraction when light passes obliquely into a medium (Snell's law). The angle of incidence is the angle which a ray makes with a perpendicular to the surface that it enters. The angle of refraction is the angle that the ray makes, as it passes through the material after being bent, with the same perpendicular to the surface.

This is because light travels slower in plastics materials than in air, thus causing bending or deflection from a straight path. Refractive index is also the ratio of the velocity of light in a vacuum to its velocity in a given substance.

The more the index of refraction differs from unity, the more the refraction. The index of refraction of glass varies from 1.5 to 1.9, depending largely upon the hardness. The index of refraction of plastics varies from 1.47 to 1.7.

PLASTIC TOOLING VALUE PROVED BY AIRCRAFT PRODUCTION

Harry W. Tompkins
Curtiss-Wright Corporation
Buffalo, New York

"Plastics? Sure, we know what they are. Don't we have table tops, ash trays, lipstick cases and dozens of gadgets made of plastics? But 21,000 pounds of new plastic *tools* in work at one time! Just a minute, not so fast!" Experienced tool makers, hardened to startling innovations and rosy promises of new materials, have precedents for skepticism. They like to be shown.

Impossible? Not at all. Curtiss-Wright in the month of June just past had that amount of plastic tooling in process for forming large skins to speed plane production. Add to this the wide variety of draw-die and stretch press plastics tools which have been in constant service beginning last summer. The answer is conclusive proof that plastic tools are in *actuality*.

Spectacular? Of course, but just one phase of the many-sided program under way at the Buffalo Plant of the Curtiss-Wright Corporation. Here it has proven its value in actual production, for during a recent thirty-day period, approximately 54,000 pounds of liquid casting resins were poured to keep abreast of the plastic tooling schedule!

Time Saver? Definitely! Case History No. 1: To shape a part of the Curtiss Commando formerly required 4 hours. Industrial plastics have made possible its production in less than 15 minutes and further refinements of the setup will ultimately reduce this to *3 minutes*. Case History No. 2: A certain quantity of complex air scoops for the Curtiss P-40 Warhawk required more than a week of three-shift effort for production. Industrial plastics are now producing the same quantity in 16 hours—and better parts! Case History No. 3: A particular wing fillet production problem was not only solved through industrial plastics but even these savings were multiplied by two since the parts were produced in pairs—left and right—at the same time!

Worth While? Those who have watched the tools at work feel that the Plastic Program is really just getting under way!

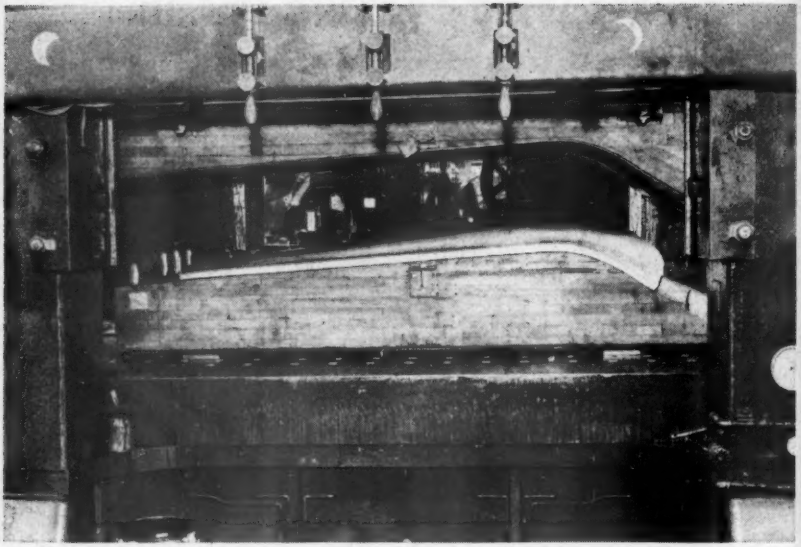
The Plastic's Family Tree is a large one with many branches but this and subsequent discussions will be confined to just one group—the Liquid Castings Resins. Extensive tests and numerous applications with this particular type have convinced Harold Clark, in charge of the Plastic Tooling Program, that in them will be found the key to future large scale development of this art. It has been his expressed hope and objective that the handling and pouring of these materials could be so simplified that the procedure could be reduced to charts and tables to enable the average individual to duplicate the results attained at Curtiss-Wright.

Cast phenolic, or liquid thermosetting casting resins, resemble the familiar molded phenolic compounds in their chemical makeup but differ radically in the methods of production as well as handling or processing the material to a finished casting. Molds, in which the liquid resin is cast, are made from various materials; wood, plaster or metal, depending on the character of the casting to be produced. The liquid resin is poured into a properly treated mold, then placed in an oven to be cured to the proper hardness.

With respect to hardness, the liquid casting resins are similar to steel, since various combinations of time and temperature when curing will produce varying hardness. This is an important point since the use for which the plastic tool is intended will determine the curing procedure in order that the resulting tool will be able to perform in a satisfactory manner.

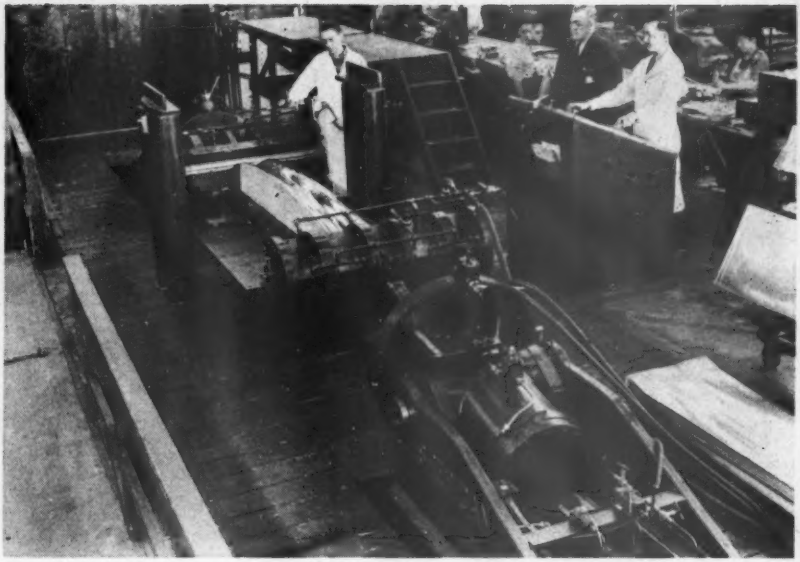
The simplicity and flexibility of the methods used in producing plastic tools,

(CONTINUED ON PAGE 128)



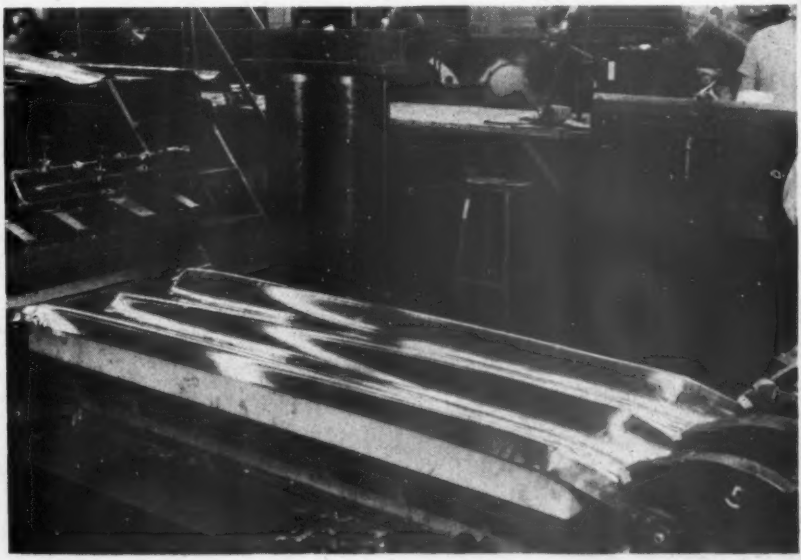
Top cowl skins for the Curtiss C-46 Commando (Navy designation R5C) are formed by this plastics punch draw die installed in a 750-ton hydraulic press. The die is opened to show the working surface of the punch.

A group of cored plastics stretch press forms are shown, still in the plaster molds in which they were cast.



A plastic forming punch is being used to form a single fairing in a stretch press.

A close up view of the dual fairing being formed over plastic. Left and right parts are produced simultaneously and later cut for completing the assembly.



A two-part stretch press form. The lower half is cored, the upper half is solid. This type of "sandwich" stretching is producing excellent results and outstanding savings.

A group of plastic draw die punches stored on their respective pressure pads. The small dee draw punch is for the air scoops for the P-40, the others are for producing cowl skins.
All plastics material shown in all photographs is Catalin No. 101 Thermosetting Resin.

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THE Cooper-Bessemer CORPORATION

DEPT. J., MOUNT VERNON, OHIO

(CONTINUED FROM PAGE 123)

the inherent characteristics of the material plus their ever improving physical properties, commend liquid casting resins for use where design changes are frequent since the tooling costs are relatively low. No other type of plastics has been adapted to such a wide range of tooling applications.

Prior to the war, most liquid casting resins were processed completely within the manufacturer's own plant, since the process had to be carried through from beginning to end without interruption, and standard curing ovens were in use. However, in the early days of the plastic program, the absence of adequate curing ovens prompted Clark to try another type of liquid casting resin designated as "accelerated". With this resin, the majority of the heat necessary for curing the casting was generated by the addition of a liquid "accelerator" to the base material. As the accelerator was thoroughly mixed with the resin, a chemical reaction took place which generated a sufficient amount of heat to promote the setting of the liquid material. On completion of the reaction, the mold was placed in a warm oven for about 8 hours at the end of which time the casting was ready for use.

While this material proved satisfactory for rush or temporary tools, the physical properties fell off sharply as the casting aged. It was, therefore, discarded in favor of the "non-accelerated" type of resin in all but a few applications where the "accelerated" is still used because of special circumstances.

With the assistance of 'Gene Roeck, Clark's assistant and co-worker in the Plastic Program, a number of outstanding draw-dies have been made and placed in operation.

In draw-die applications, the force on the plastic punch is entirely compressive. While the early liquid casting resins were not too high in physical properties, consistent work with the material and improved handling technique has built them to a point where, with proper curing, a compressive strength of 33,000 psi can be developed. This is more than adequate for draw-die application and the dies are usually installed in the 750-ton hydro press.

Structural changes to airplanes, based on combat experience, necessitate that flexibility be maintained in the tooling program. To maintain this flexibility, the plaster forms department is the ideal teammate for plastic tooling. Developed to a high state of perfection, the plaster forms make available accurate molds for the casting of liquid resins at substantial savings over other methods. The combination of these two methods, make it possible to keep abreast of the required changes with a minimum expenditure for tooling. Speed of production is another benefit of the plaster and plastic method.

This article has been written to give a broad over-all picture of the Plastic Tool development at Curtiss-Wright. Production experience with this tooling indicates that its basic advantages assure it a permanent place in the tooling picture of tomorrow. Those who may question this assertion should consider the following:

Men who have practical experience in application of plastics are aware that theory and practice are two different things. In a material, which prior to the war was confined in application to "gadgetry" and decoration where the sole requirement was sales appeal, there have been discovered physical properties which may be altered to suit a specific requirement simply be varying the technique of handling or the factors of time and temperature in curing. It is definitely the processing which determines the end results. However, the material is so sensitive that even a slight deviation in handling may cause a disappointment.

Records tell the story and the case histories in diversified applications indicate that Plastic Tooling as used at Curtiss-Wright has definite advantages. These records also indicate that beginning *now* the planner and tooling engineer should begin to revise their thinking and approach the subject with an open mind to learn if these progressive methods and materials can be adapted to their production requirements.

This is the first of a series of three articles on the subject. The second will cover the design and use of plaster patterns and their relation to the development of plastic tooling.

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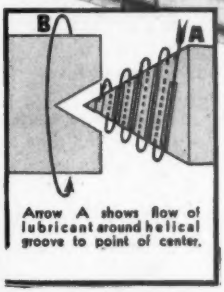

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Before a job is started every blue print is checked for dimensions and tolerances, and processing of work is begun. This engineering control prevents costly rejections — and has accounted for time and material saving improvements.

The second quality control is special production tools—jigs and fixtures of our own design built here in our complete tool and gauge shop—to accurately meet these individual requirements.

In processing production C. M. Smillie maintains a third quality control — combining modern equipment and skilled operators in every operation—machining, grinding, thread milling, finishing and inspection. This co-ordinated engineering, tooling and production precision control is responsible for our high rating in the production of Army and Navy material.

In production after Victory forward-minded executives will recognize that this true precision performance means *extra* value in their products.

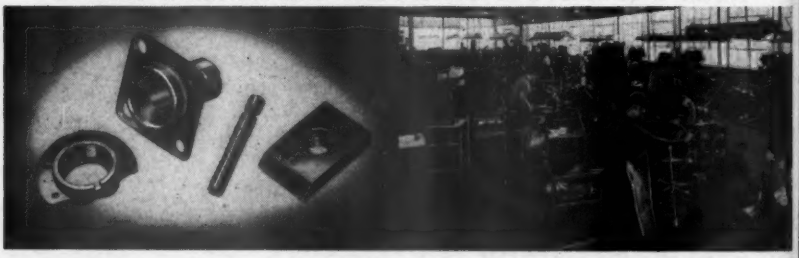
C. M. SMILLIE & CO.

1108 WOODWARD HGTS., FERNDALE, MICH.

TOOLS PRECISION SCREW MACHINE PRODUCTS FIXTURES

PRECISION ◆ YESTERDAY ◆ TODAY ◆ TOMORROW

SERVING INDUSTRY AND THE NATION FOR FIFTY-FIVE YEARS



The C. M. Smillie Company is interested in developing precision products for post war manufacture. To parties with new inventions or products we have the experience, facilities and organization for successful manufacturing and distribution.

PROGRESS ON PARADE

RADIAC SYNTHETIC RUBBER CUT-OFF DISCS AND GRINDING WHEELS. Despite the skepticism with which synthetic rubber abrasive discs and wheels have been regarded, they have proved, in many respects, to be superior to crude rubber discs and wheels. Field tests revealed that Radiac synthetic rubber wheels and discs are advantageous for long wheel life, fast, free cutting, excellent finish and little burn. They are manufactured by A. P. de Sanno & Son, Inc., in the standard range of thickness and in diameters up to 20". Radiac synthetic rubber wheels have shown effective performance on wet grinding of ball bearing races and roller bearings. The cut-off discs show remarkably fast cutting qualities on cold rolled and high speed steels, roller bearing stock, glass rods and tubing. A. P. DE SANNO & SON, INC., 464 Wheatland St., Phoenixville, Pa., will send additional information on request. **262-M**

IDENTIFICATION MARKING FLUID. To coincide with arbitrary code systems in the average stockroom, Dayton Rogers Manufacturing Co. has compounded an identification marking fluid in twelve distinct colors for use on sheet strips and bar alloys, according to the manufacturer's own selected code. It may also be used to advantage on all layout work or inspection departments. Polishing or finishing of the material is not necessary; it is simply brushed on and dries instantly. This fluid can also be used advantageously on various hardened and ground parts for part number marking and other identification. The remover obliterates part numbers and other identification marks no longer needed. It is packed in handy combination brush-in-cover containers, complete with ink pads and marking pens. If more information is desired, write DAYTON ROGERS MANUFACTURING CO., 2844 12th Ave., S., Minneapolis 7, Minn. **619-M**

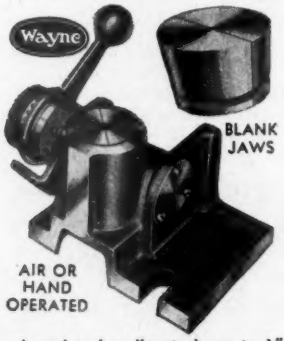
PARK QUENCH OIL ACCELERATOR. a new all-mineral product of Park Chemical Co., Detroit, steps up the performance of ordinary quenching oils to the performance levels of fast quenching oils and makes it unnecessary to throw away used oils when faster quenching rates are sought. By adding their Accelerator in a ratio of one to four to the oil already in a system, the viscosity, flash and fire points of the original oil are raised slightly while cooling rates for steel are definitely increased. Deleterious elements in the original quenching oil are diluted without any stratification or settling out. Company technicians advise that once any plain mineral quenching oil is thus modernized and speeded up, it should be replenished with Park No. 200 Quenching Oil. It is pointed out, however, that the Accelerator cannot be regarded as a substitute for a new quick action oil and that when a choice is available a complete installation of Park No. 200 Quenching oil is preferable. But where salvage of most of the original oil is sought, the Accelerator is considered an economical means of obtaining maximum oil quenched hardenability from all steels, N. E. grades and standard alloys alike. PARK CHEMICAL CO., 8072 Military Ave., Detroit, Mich., will send further details. **756-M**

ACROMARK NO. 9AMP MARKING MACHINE. A new pedestal type power machine for marking flats with a roller die or for marking rounds with a flat straight line die has recently been developed by The Acromark Company. The machine is heavily constructed, eliminating vibration. The mark is obtained as the flat die or type passes over the part placed on the cradle roll. The open front and back permit the work to flow uniformly to, through, and away from the machine. For large parts that have to be lifted to and from the machine, a clutch lever is used to control the marking head for each marking stroke. The cast iron head, that holds the adjustable steel slide carrying the

type and die holder, slides on a heavy steel shaft. All moving parts are bronze bushed or are of cast iron against steel; standard motors and roller bearing gear reduction units are used. The No. 9AMP is 46" high overall, 24" deep overall and 36" wide overall. A wide range of accessories such as specially formed cradle rolls for odd shapes or contours and mandrels or stud mountings to hold hollow cylindrical parts are available for use with the machine. Detailed information on this new marking machine and special fixtures will be sent by THE ACROMARK COMPANY, 5-15 Morrell St., Elizabeth 4, N. J. **636-M**

A NEW FLAT TOP PORTABLE LIFTING TABLE has been designed by the Barrett-Cravens Co. for the simple and speedy handling of dies to and from machines, storage shelves, etc. The flat table top is easily adjustable to heights ranging from 24" to 40" with a crank-up mechanism. The tables have also been found useful for supporting and leveling long bars, sheets, frames, etc., for fabrication on horizontal mills and many other applications around machine shops. The Barrett Lifting Tables are of electrically - welded steel construction and are available in two sizes. Style No. F-1 has a table size of 28 x 40" with a maximum weight capacity of 3000 lbs. Style No. F-2 has a table size of 24 x 32" and is designed for a maximum table load of 2000 lbs. Both styles are equipped with heavy duty ball bearing casters and may be furnished with steel brakes. BARRET-CRAVENS CO., Dept. TD, 3269 W. 30th St., Chicago, Ill. **982-M**

COLLET CHUCKING FIXTURE. The new Wayne Hand or Air-Operated Collet Chucking Fixture is an improvement over the original Wayne fixture, yet it uses the same four-piece blank collet featured in the previous model. The collet jaws are constructed in four segments and breaking is accomplished by four springs. The jaws move parallel, securely gripping the surface in a complete 360° circle and for a much longer span than with a standard collet in which the "spring" is obtained by the angle of the jaws. The collet



may be bored to handle stock up to 1" if the depth of drill is not over ¾"; the size limit is $\frac{7}{16}$" if stock must pass through the collet. The fixture may be operated entirely as an air-powered unit with automatic control valve synchronized with the machine, or it may be used entirely as a hand-operated chucking fixture and the motor may be added at any time. An illustrated folder fully describing the Wayne Collet Chucking Fixture will be sent on request by WAYNE PUMP CO., Dept. J, Fort Wayne 4, Ind. **745-M**

WEDDELL FLYWHEEL ARBORS AND ADAPTORS. It has been found that carbide milling is best performed if flywheels are in-

ANGLES

To a minute in a minute with a BEMISINE

● The Bemisine speeds up and simplifies setting any angle from 0 to 90°—using only a 2" Micrometer*! *It holds the work! Faster than a Sine Bar or Protractor! A Jig Eliminator on Surface Grinders and Jig Borers!*

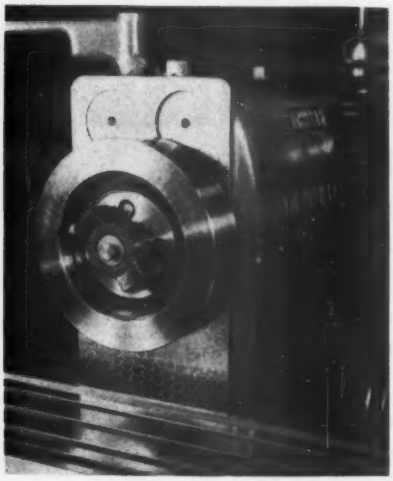
*Also used with standard gage blocks.

SEND FOR Bulletin describing this new solution for an old Problem!

NICHOLS-MORRIS CORPORATION

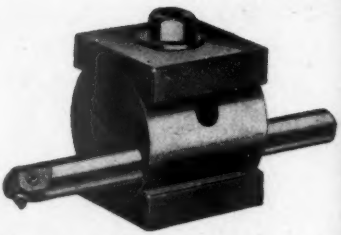
50 CHURCH STREET NEW YORK 7 N. Y.

corporated in the drive, thus absorbing vibration and fluttering caused by the intermittent cutting of very coarse toothed cutters. WEDDELL TOOLS, INCORPORATED, 1235 University Ave., Rochester 7, N. Y., have, therefore, developed simple flywheel arbors or adaptors as an adjunct to the use of carbide or fly cutters. The flywheel arbor replaces the



standard shell end mill arbor and mounts on the spindle of the machine. The milling or fly cutter is fastened and driven onto the arbor and flywheel nose, which is made in any of the standard sizes from ¾" to 2½" diameter. For use with cutters which fit directly on the spindle, a flywheel spindle nose adaptor is offered. The Weddell Flywheel Arbors and Adaptors are manufactured in standard sizes. Write today for more information. **804-M**

BORING BAR HOLDER. Welch Tool Engineering Co. of Los Angeles is the manufacturer of a new Universal Boring Bar Holder with an "up and down" adjustment to center. This adjustment eliminates shimming and enables the operator to immediately locate the cutting tool on center. The holder fastens directly in the tool post T slot of the compound rest and the boring bar is always level and parallel to the spindle of the lathe. The holder and bar are locked rigidly in position by tightening one nut. Any size bar can be used, up to the capacity of the holder, by inserting split bushings. It is made entirely of bar steel—no castings—and can be used for turning as well as boring operations. The holder is available in two sizes, for 8" to 10" lathes, ⅝" maximum bar; and for 12" to 16" lathes, ¾" maximum bar. Standard



equipment includes one double end bar. Write for descriptive literature to WELCH TOOL ENGINEERING CO., 3011 Verdugo Rd., Los Angeles 41, Calif. **A50-M**

A NEW ELECTRICAL TACHOMETER is being introduced by the R. B. Brigham Co. which will meet every speed measuring requirement. The power unit is equipped with special sealed ball bearings and a permanent magnet rotor designed for long, trouble-free operation. No brushes, commutators or gears are used. The use of conversion tables or charts is eliminated by special calibrations on the scale of the indicator, insuring the quick reading of revolutions per minute, feet per minute, frames per second, gallons per hour, pounds per minute and any other unit of measure. The readings on the indicating

scale are guaranteed within ½ of 1% of the full scale and direct scale readings up to 50,000 rpm's are possible. The power unit on the portable testing instrument illustrated has a plastic housing, permitting an easy hand hold. Four rubber tips are provided so that speeds of any type shaft, whether centered or uncentered, can be easily determined. The complete unit, power generator—motor—electric cord—etc., are all enclosed in a handy carrying case. The R. B. BRIGHAM CO., Dept. T, 329—16th St., Toledo, O., will send full information with engineering data on request. **A69-M**

FOUNDRY METAL CUTTING MACHINE. Designed to meet foundry needs and engineered to stand up under present production requirements, the DeWalt Metal Cutting Ma-

Deliveries NOW Within 30 Days

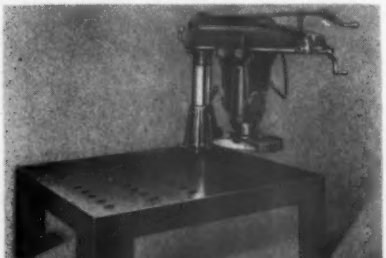
Here's a typical, everyday use for Johansson Gage Blocks—a time-saver that makes real inspection accuracy a simple, rapid-fire operation. Using a stack of JO-BLOCKS and an ordinary surface gage, set your dial indicator at zero on the blocks—if the work measures zero too, it's *right*. Hundreds of other uses, such as in tool set-up, in laying-out, in scribing, in checking mikes and working gages. Popular Set No. 1, of 81 blocks, makes 120,000 different size gages, in steps of .0001 from .200 of an inch to more than 12 inches. JO-BLOCKS are much lower in price than most folks think. Two grades —accurate to .000004 and to .000008. Deliveries now within 30 days on all standard sets and accessories. Write for catalog 16. Address: FORD MOTOR COMPANY, Johansson Division, Dept. TD, Dearborn, Michigan.

Ford

Johansson

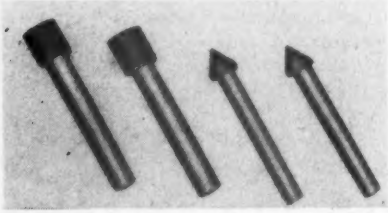
GAGE BLOCKS

chine does its job quickly and with a minimum of operator effort. The arm on this machine can be rotated a full 360°, right or left, and the motor can be positioned at any point on the arm, enabling the operator to make cuts from any position. When a casting is too large to mount on the table, the operator simply moves the arm to the right to clear the



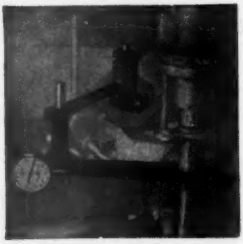
table; the cutting wheel can then be lowered to within 20¾" of the floor and raised 37¾" above the floor. A chain feed permits the operator to maintain complete control at all times. State your cutting problem when you write DeWALT PRODUCTS CORPORATION, Lancaster, Pa., for details. **986-M**

TUNGSTEN DIAMOND BURRS AND WHEELS. The Champion Diamond Company of New York has recently announced the development of tungsten diamond impregnated burrs and wheels. These consist of tungsten powder and diamond grit, mixed together and formed. The burrs and wheels have been found very suitable for use on tungsten steel



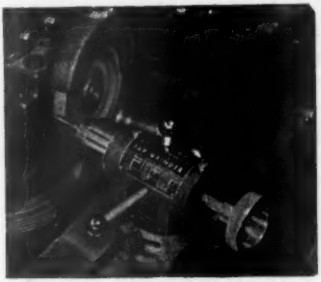
dies or wherever ordinary burrs cannot be used. These tungsten diamond burrs and wheels have also proved advantageous for fast deburring, for precision surfacing and for smoother final finishing. CHAMPION DIAMOND COMPANY, 551 Fifth Ave., New York 17, N. Y. **766-M**

STUART MICROMATIC VISUAL GRINDING GAGE. The recently announced Stuart Micromatic visual grinding gage has, it is claimed, materially contributed to greater accuracy and speed in precision grinding operations. The gage is applied to and taken off the work while the grinding machine is in operation and thus eliminates hand "miking". By directly indicating the correct dimension, even



though the sizing controls of the machine are worn, the dial indicator guides the operator as the work is ground to final size. Grinding tolerances of plus or minus .0001" are easily maintained. The dial is actuated by direct parallel thrust. The gage is made in two models with ranges of ⅛" to 1¼" and ⅝" to 2½"; additional calipers for the larger models provide ranges of 2" to 5" and 5" to 8". CLAWSON & BALS, INC., 4701 West Lake St., Chicago, Ill. **A59-M**

THE READING TAP GRINDER, manufactured by the Reading Machine Co., is a readily portable unit for use on almost any type of tool and cutter grinder, cylindrical grinder, on the magnetic chuck of a surface grinder or even a bench lathe. Tap chamfers can be quickly and easily sharpened with the Reading Tap Grinder. Resharpening the chamfer



eliminates discarding taps when the point becomes dull. The chuck furnished with this tap grinder accommodates hand taps from ⅛" to ¾" in diameter. Taps can be changed from one style to another and the amount of relief may be changed on existing taps for different materials. READING TOOL CO., Dept. D, Reading (Cincinnati) O. **A68-M**

HOW TO REGRIND COMPOUND ANGLE TAPS

12 TIMES FASTER!

Now, with this Universal precision indexing head you can grind completely in 5 minutes what normally takes 2 to 3 hours of laborious trial and error work—and duplicate the factory finish on as many taps as you want. Just check this case study—A special tap required 3 angles to be ground, a 45° breaking angle, a 15° gun barrel angle and a 3° hook angle on the gun barrel angle. Using the 3 indexing planes (an exclusive feature), only 2 passes per flute under the wheel were necessary to get number fit and exact duplication.

INDEXES 360° IN THREE PLANES

You, too, can use this remarkable attachment profitably. Holds tools firmly, indexes 360° in each of three planes, for any possible simple or compound angle. Bolts onto any tool or surface grinder you may have. Gives you higher precision work because you needn't shift tool in holder. Vernier lever rotates work collet between adjacent indexed points without changing index, giving you control to 1/10 of 1 degree.

You eliminate inaccuracies because all work is accomplished by mechanical setting, and less handling is required. Collet quill is carried on aviation ball bearings instead of ordinary sleeve bearings to reduce friction for spiral grinding. Result is greater accuracy and speed in regrinding tools.

GET COMPLETE STORY!

Investigate this unusual grinding attachment. In addition to holding all the standard tools listed below, it is easily adapted to holding irregular and large shank tools for grinding. Some even use it for light milling work. Among the prominent users who reorder are Boeing Aircraft, Chrysler, General Electric, Sperry Gyroscope, Nash-Kelvinator. Write today for the whole story. It will pay you.

UNIVERSAL THREE PLANE INDEXING HEAD is the only head of its kind . . . can be used on ANY tool or surface grinder . . . holds straight shank, No. 4 Morse Taper and No. 9 B & S Taper tools.

1 Holds straight shank tools up to 1" diameter in standard Hardinge Full-In collets (Type 1-AM).
2 Quill is ground to hold No. 4 Morse Taper tools.
3 With conversion sleeve (furnished) holds tools up to No. 9 B & S Taper.
1
2
3

CLEVELAND
TOOL ENGINEERING CO.
1261A W. FOURTH ST.
CLEVELAND, OHIO

SEND COUPON TODAY!

CLEVELAND TOOL ENGINEERING CO., 1261A W. Fourth St., Cleveland, Ohio

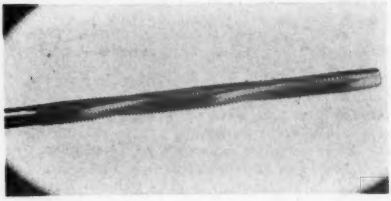
Please send complete story and Data Sheet A showing how Universal Indexing Head can help me.

NAME .....

ADDRESS .....

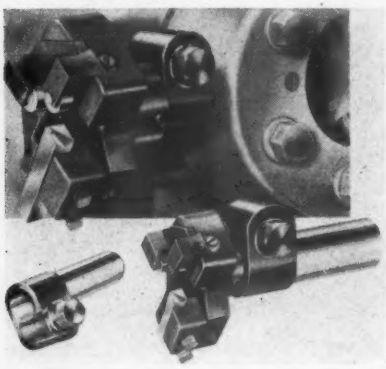
CITY .....STATE .....

MULTIPLE THREAD TAPS FOR AIRCRAFT FITTINGS. Special Acme multiple thread taps for threading of quick removable type fittings are being produced by Detroit Tap & Tool Co. Such special taps currently in production range from ⅜" to 1" diameter, of both 12 and 10 pitch, while available types range from double to sextuple thread taps. Exceptional accuracy is required of, and pro-



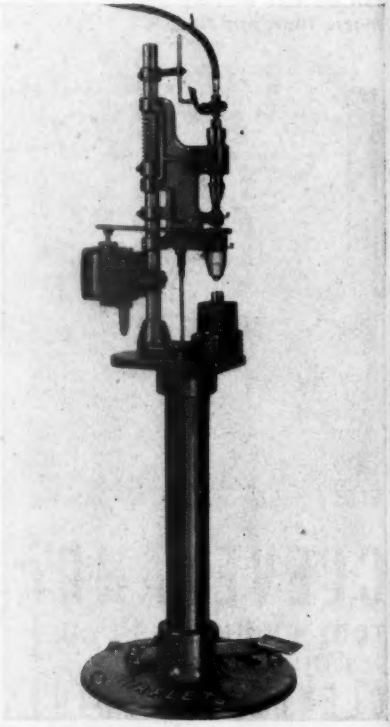
vided in these taps in order to permit easy removal, without looseness, of such fittings as are frequently tightened or removed with electric motor operated devices. These taps are now being used in aircraft assemblies for fastening cowling, etc. Requests for further information will be filled by DETROIT TAP & TOOL CO., 8432 Butler St., Detroit 11, Mich. **134-M**

THE MODEL H SCREW MACHINE ADAPTER now being manufactured by the Boyar-Schultz Corp., is designed to permit the use of more than one size tool on a single screw machine. In fact, this new tool doubles the capacity of screw machines. It is precision made through-



out of the best tool steel, hardened and ground to assure correct fit. It is manufactured in four sizes: 5/16" to ¾" short; 5/16" to ¾" long; 5/16" to 1" and ¾" to 1". Larger sizes will be available in the near future. Literature will be sent on request by BOYAR-SCHULTZ CORP., 2112 Walnut St., Chicago 12, Ill. **612-M**

AIRFLEX SPINNER RIVETER. The Airflex Equipment Co.'s latest models of riveters include an Advance Pressure Pad consisting of an aluminum housing, spring and pilot with the pilot forerunning the peening tool to hold the assembly rigidly against the rivet set. This eliminates fatiguing vibration and makes accurate work easier. Operating at 4,000 to 6,000, the Airflex Spinner Riveter handles round, oval, flat head rivets; peens shafts, pins and studs; furls or swages shoulder bushings and light tubes to sheet metal or plastics. While rotating, Airflex delivers these short (¼" maximum) strokes in rapid succession from an air operated peening tool. A ⅛ hp ball bearing type vertical motor with push button control is used for the rotating motion while the air is regulated by a petcock to adjust the force and frequency of the blows. Frame travel is approximately 2" and the throat depth is 5"; frame adjustment on post is 4" to accommodate various sizes of assemblies. The Airflex Spinner Riveter is supplied in three models. Write for details to AIRFLEX EQUIPMENT CO., 13255 Birwood, Detroit, Mich. **A6-M**



METAL Stampings DUPLICATED WITHOUT DIES

With DI-ACRO Precision Machines

If you desire to save time and critical materials on production of metal stampings or other small parts, then the DI-ACRO System of "Metal Duplicating Without Dies" merits your consideration. It is based on the rapid and accurate production of formed parts with DI-ACRO Shears, Brakes and Benders. All duplicated work is accurate to .001". These precision machines are adaptable to an endless variety of work, and ideally suited for use by girl operators. For short runs your parts are processed in a matter of hours instead of waiting weeks for dies.

SHEARS

Di-Acro Shear squares and sizes material, cuts strips, makes slits or notches, trims duplicated stampings. Shearing width—Shear No. 1—6". Shear No. 2—9". Shear No. 3—12".

BRAKES

Di-Acro Brake forms non-stock angles, channels or "Vees." Right or left hand operation. Folding widths: Brake No. 1—6". Brake No. 2—12". Brake No. 3—18".

BENDERS

Di-Acro Bender bends angle, channel, rod, tubing, wire, moulding, strip stock, etc. Capacity—Bender No. 1—$\frac{1}{4}$" round cold rolled steel bar. Bender No. 2 and No. 3—$\frac{1}{2}$" cold rolled steel bar.

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"DIE-LESS DUPLICATING"

It illustrates many stampings or parts made without dies, gives full details on DI-ACRO machines and shows how they may readily be adapted for various applications. Request your copy now.

DI-ACRO PRECISION MACHINES DIE-LESS DUPLICATING

Pronounced "DIE-ACK-RO"

O'NEIL-IRWIN MFG. CO.

315 Eighth Ave. So. Minneapolis 15, Minn.

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PRODUCTION for PEACE

Only efficient, low cost production can hope to survive when conversion from war to peacetime production becomes a reality.

The Marveco live center has proven itself in war production to be the most reliable and efficient tool in its class. Why not have your engineer study Marveco for your postwar program?

The MARVECO is GUARANTEED to OUTPERFORM and OUTLAST any other LIVE CENTER.

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SCIENCE • RESEARCH • METHODS • TOOLING
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A Notch and Cut-Off Die

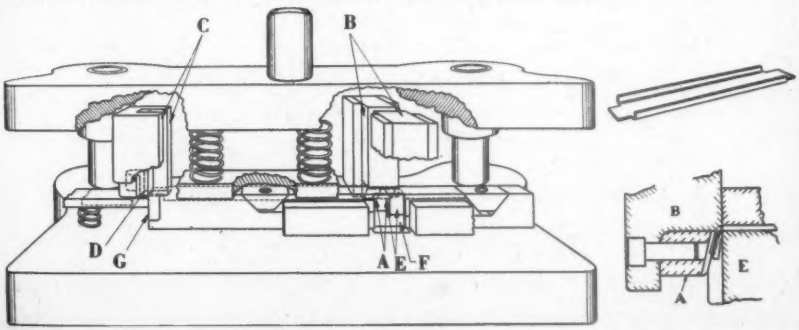
A notch and cut-off die, a two stage or station die for producing a channel metal section in one operation on a punch press, was devised by E. H. Girardot, a tool design foreman at General Electric's Schenectady Works. The die not only saved time over the old method of cutting the channel to length and then straddle-milling the notches on both ends but provided, by means of a locating step in an adapter block, a means of quick, positive setting of the cutting members.

A combination of shearing and notching punches is utilized in the first station for removing the metal for the notches on the end of the part. The tapered punch inserts "A" shear the sides of the notch from the channel as they pass the die sections "E". As the die continues to close, the solid notching punches "B" complete the notching operation at the bottom of the press stroke.

In the second station two pilot blocks "C" pick up the notches, accurately positioning the part to length before the work piece is clamped and before any cutting starts. A cut-off punch "D" mounted between the pilot blocks cuts off the completed blank.

The adapter block "F" is provided with a permanent locating step representing the center line of the first die station. The die sections "E" can be readily replaced after grinding and are locked by means of taper wedges. The punch inserts "A" are quickly removable for grinding. They are accurately relocated in their cutting positions by backing shims which take up an amount equal to the metal removed in grinding. The inserted plate "G" in the second or cut-off station is repositioned in a similar manner after sharpening.

The preliminary stops in both stations and the positive pre-locating stop for the end of the strip being fed are not shown on the sketch. The completed parts drop into a chute at the end of the die and are conveyed to tote boxes for handling to subsequent piercing and forming operations.



Fishpole Guide Rings

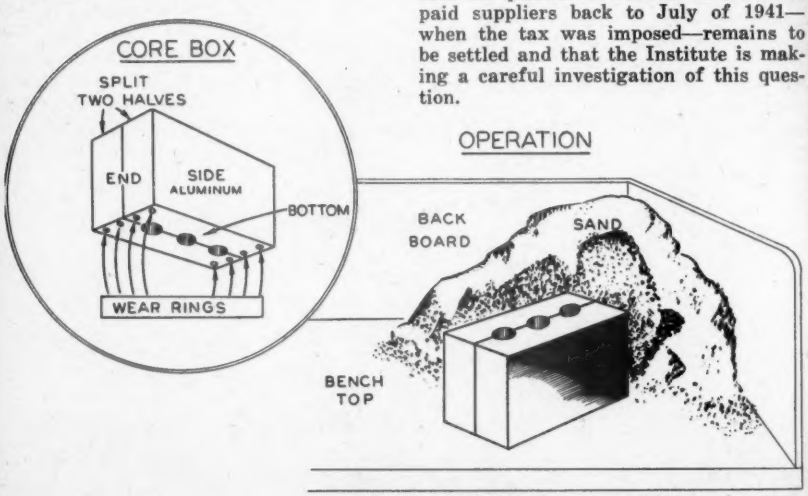
Cemented carbide fishpole guide rings designed for withstanding the wearing actions of fishing wire or sharp, hard silk fishline have been put to a new, yet very practical use in an Ohio foundry. They have been inserted on the bottom of aluminum core boxes, as shown, to absorb the abrasive action of the core sand on the bench as the molder smoothed the core sand off the bottom.

The mold, made in halves and of aluminum, was filled with a tamped down core sand. The usual procedure of rubbing the box over the bench to smooth off the bottom wore away the bottom of the boxes unevenly. This put a strain on the dowel pins used to line up the halves, making overhauls or scrapping necessary after approximately 1,500 cores.

The fishpole guide rings of cemented carbide were secured from Carboloy Co., Inc. They functioned as "hob nails". The hard abrasive-resisting rings took the brunt of the wear as the boxes were slid along. The result has been a large saving in replacing or repairing the boxes; the carbide ring equipped boxes producing 9,000 or more cores between overhauls. 82-M

Illinois Sales Tax Ruling Interests Tool and Die Shops

In Illinois it is no longer necessary for tool and die shops to pay the Retailers' Occupation Tax on materials bought from suppliers, and from which are fabricated dies, jigs, fixtures, and gages for resale. This announcement has just been made by George W. Rockwood, Secretary of the Chicago Tool & Die Institute, 176 West Adams Street, Chicago. However it should be carefully noted that the tax must continue to be paid on all supplies and materials, which a tool and die shop buys for use and consumption on the premises. It is necessary to furnish the seller (the tool and die shop's supplier) with a certificate of resale when die sets and other material are purchased for resale; such certificates must accompany the purchase order, and constitute an informal letterhead memorandum setting forth the facts. Where a certain percentage of all purchases from a given supplier are for the purpose of resale, a blanket certificate of resale may be furnished, stating that a designated percentage of the purchases is for the purpose of resale. And similarly, if all purchases from a supplier are for purposes of resale, that fact should be stated in the certificate memorandum. Mr. Rockwood advises that the question of rebates on the taxes paid suppliers back to July of 1941—when the tax was imposed—remains to be settled and that the Institute is making a careful investigation of this question.



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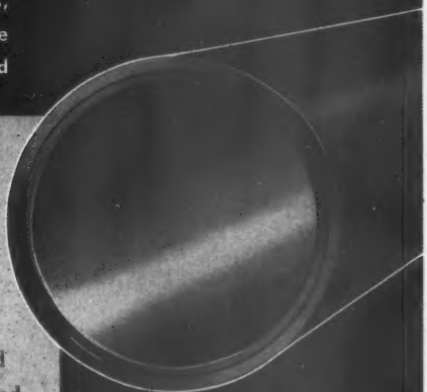
is now available to all industries

Diameters 2 to 12 inches, lengths to 5 feet; one piece or a thousand



"A honed surface is a much longer wearing surface."

If you already know the economy of *stock-removal* and the superiority of *surface-finish* regularly attained with Empco Honing, we need only invite you to send your prints for estimates and delivery dates.

If you have not yet investigated this fast, modern, more economical method of better hole-finishing, let us tell you about it now.

Prompt Service
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2731 JEROME AVE. DETROIT MICH

Industry is Buying the Reamers
GROUND FROM THE SOLID HEAT-TREATED BAR

Orders for L & I Ground Flute Reamers are pouring in faster than ever—as America's production specialists discover their superiority—in cutting edge, production performance and long life.

Reamers were just reamers—before L & I started grinding them *from the solid bar* after that perfect heat-treating agent, the round bar, had been hardened. The new result was extra, uniform hardness and uniform cutting edges that do their work faster and cleaner and *longer*. L & I Ground Flute Reamers are making production records. Why not let them improve your results and save your money?

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PUBLICATION PREVIEWS

SALES AND TECHNICAL LITERATURE

Send Request on Company Letterhead

OPTI-FLAT SURFACE PLATE. This glass plate is guaranteed optically flat to .00005" and insures topmost precision for gaging the height, parallelism, and accuracy of straight, angular, square and flat surfaces and edges. Optical Flats, as shown in a 4-page folder published by the GEORGE SCHERR CO., INC., Dept. J, 128-B Lafayette St., New York 13, N. Y., are widely used for the precision checking of lapped surfaces of gage blocks, micrometer anvils, snap gage anvils, etc. **490-M**

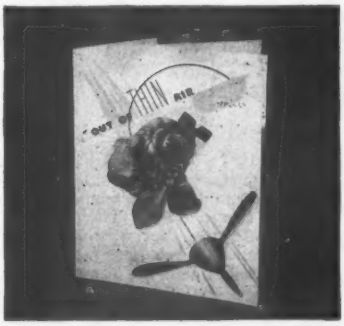
DANLY DIE MAKER'S SUPPLIES, the 10th Edition of this very complete catalog is divided into five parts: precision die sets assembled with hardened, ground and lapped posts and bushings; commercial die sets; large and semi-steel die sets; all-steel die sets; and die makers' supplies. Complete specifications and prices are given along with detailed instructions for ordering. Address DANLY MACHINE SPECIALTIES, INC., Dept. J, 2100 South 52nd Ave., Chicago 50, Ill. **A56-M**

SHAPER, MILL AND LATHE drive installation details are presented in a bulletin issued by WESTERN MFG. CO., Dept. TJ, 3400 Scotten Ave., Detroit, Mich. The Master Transmission has capacity up to 5 hp and the Major Transmission up to 10 hp. Western recommends that transmissions operate on input shaft at or near 900 rpm to insure long life. This bulletin will be of help when attaching brackets and ordering V belts, sheaves and output pulley. **83-M**

"HARD CHROME PLATING"—A practical guide to the industrial application of chromium plating has been issued by the ADVANCE PLATING CO., Dept. TD, 395 E. 131 St., Cleveland, Ohio. Various data and tabulated information are included that can help determine the savings and production increases possible in plants through the use of hard chrome plating. Its ability to resist wear, abrasion, corrosion and heat, plus its low coefficient of friction is described. Unusual applications of hard chromium plating are presented along with many common industrial applications. **A26-M**

HAMMER FORGED DRILLS are featured in a folder issued by the AMPCO TWIST DRILL CO., Dept. D, Jackson, Mich. The different steps in the processing of Ampco drills are explained along with illustrations. These drills are ground between centers and then polished thus insuring concentric webs and perfectly proportioned drill flutes. **762-M**

DEVELOPMENT OF FRACTIONAL HORSEPOWER MOTOR DESIGN since the beginning of the war is presented in a new brochure entitled "Out of Thin Air" prepared by the DUMORE CO., Motor Div., Dept. TD, Racine, Wis. This booklet, illustrated in full color, explains how the unique and exacting standards imposed upon motor manufacturers by the requirements of aircraft applications have telescoped years of normal development in motor design into a few months. These new



motors incorporate safety and protective devices, versatility, controllability and durability which will be important factors in the design of motor driven products for the post war home, farm and office. Product designers will be interested in the possibilities this publication will suggest for their own design work, and in the application of quality control to maintain precious standards in high volume production. **561-M**

FORD CARBIDE CUTTERS, the newest additions to the Ford line of rotary tools, are recommended for those desiring a rotary tool of extreme hardness, capable of continuous usage and fast cutting. These carbide rotary cutters are featured in a catalog issued by M. A. FORD MFG. CO., INC., Dept. T, 739 W. First St., Davenport, Ia. The illustrations are enlargements but exact dimensions of carbide cutting heads are shown with each tool number. All are provided with ¼" diameter shanks. **A42-M**

PRECISION MACHINE TOOLS and cutting tools consisting of thread grinders, boring, turning and facing machines, universal fixtures, carbide tool grinders, lapping machines, grinding spindles, Continental cutting tools, hydraulic power units, drill jig bushings, Diesel fuel injection equipment, railroad pins and bushings and precision parts are comprehensively detailed and illustrated in Bulletin No. 27121 published by the EX-CELL-O CORP., Dept. T, 1200 Oakman Blvd., Detroit 6, Mich. **737-M**

PRECISION PRODUCTION TOOLS are illustrated and described in Catalog No. 44 recently published by the ACME TOOL CO., Dept. D, 196 Church St., New York 13, N. Y. This catalog features unusual production tools which have contributed to increased production wherever used. **69-M**

DIE & MOLD DUPLICATORS for production profiling and duplicating are presented in an illustrated booklet issued by GEORGE GORTON MACHINE CO., Dept. J, 1319 Racine St., Racine, Wis. The Duplicator can be easily converted into a milling machine or vice versa in five minutes. Deep serpentine grooves, sharp shoulders, steep angles, vertical sides and difficult shapes can generally be accurately duplicated with ease and speed. **711-M**

RIGID LIVE CENTERS which help to hold delicate threaded parts to a .0005" tolerance on a thread grinder are illustrated in Catalog 1002 issued by AERONAUTICAL PRODUCTS, INC., Dept. TD, Detroit, Mich. These centers operate cool and smooth under heavy load at high speed without loss of lubricant due to patented oil retaining seals in spindle head. They are built to absorb heavy pressures from knurling, deep cuts and heavy parts. **A53-M**

LIMA MAGNETIC POLISHING LATHE is described in an 8-page illustrated Engineering and Data bulletin released by the LIMA ELECTRIC MOTOR CO., Dept. J, 878 Findlay Rd., Lima, Ohio. This magnetic chucking lathe is designed for the specific purpose of speeding up production by eliminating the difficulties encountered in holding odd shapes or sections in a conventional chuck or collet. It is especially suitable for highly finished parts, as it leaves no chuck or collet marks to be polished out after the main operations have been completed. The lathe holds parts from ⅞" outside diameter up. Several different types of face plate applications for holding work to be polished, burred or lapped are illustrated. **571-M**

Silent operation, ease in striking arc, wide range of application, low initial cost, economy of operation, negligible upkeep, burn-out proof transformers, all go to distinguish K-O *Welders*. These time tested units are made to serve their employer well and show him a substantial profit whether on maintenance or production.

20 to 550 amps.

Write for Bulletin No. 36-74

K.O. LEE CO.
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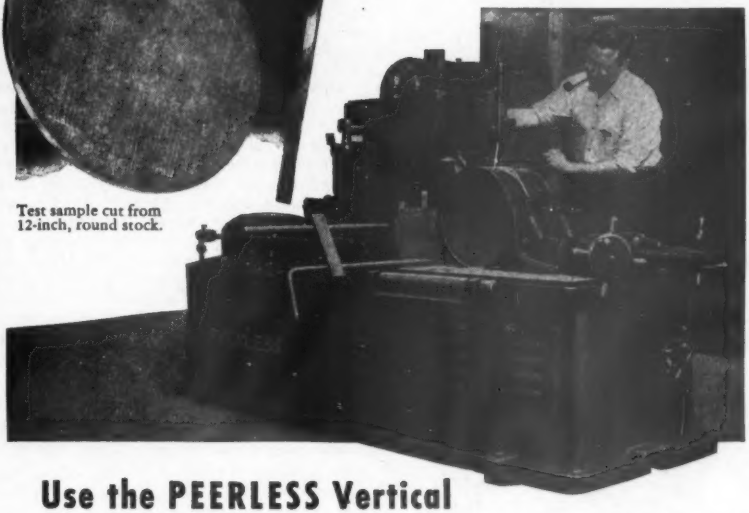
Test sample cut from 12-inch, round stock.

Saws STRAIGHT as a die!



Use the PEERLESS Vertical For Cutting Test Samples . . . Slotting and Slitting

As little as 1/16" is taken for the cut — only 1/32" is left for planing to finish when you saw your metals with a Peerless Vertical. This is the only hydraulically controlled metal cutting Saw that will handle 10" x 24" stock without turning the work. Saws 24" on face of cut.

Worn dies, given a truing cut with a Peerless Vertical, are re-used for other service. Squarely cut pieces, otherwise scrapped, are usable for shearing dies, strippers and stripper plates. Loading by crane . . . cutting at any angle . . . and full hydraulic control — are a few of the many advantages which distinguish the Peerless Heavy Duty Vertical. Mail the coupon for your copy of Bulletin 53.

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LICATION VIEWS

LARGE HOT-COILED SPRINGS are presented in an illustrated folder recently published by the MUEHLHAUSEN SPRING CORP., Division of Standard Steel Spring Co., Dept. T, 875 Michigan Ave., Logansport, Ind. The steps in manufacturing large springs are shown in sequence. Also shown are the facilities necessary and operations required to fabricate these springs in quantity and yet hold to the tolerances demanded by the application of the spring. The booklet represents a quick trip through the hot-coiling plant of the Muehlhausen Spring Corp., and high-lights the extensive equipment that enables this company to produce the exact type and size spring to meet any application and in the desired quantities required to fit in with production schedules. **751-M**

NEWFIELD UNIVERSAL FLY CUTTERS cut production costs, speed milling operations and reduce maintenance expenditures. The cutter body, of a special cast alloy containing nickel, molybdenum, steel and iron, has provision for four or six tool bits. The tool bit holders are of case hardened steel. Each of the tool holders is adjusted by a single screw and is free to rotate completely. Cuts of complicated profile may be broken down into simple units or sections and each tool bit may be ground to reproduce one of the profile sections. The cutters are precision machined throughout and carefully balanced. They fit all standard arbors and are made in four, six, eight and ten inch sizes, with special sizes obtainable upon application. A four-page bulletin, illustrating interesting applications and giving detailed specifications is available from NEWFIELD MACHINED PARTS CO., Dept. TD, 7160 Melrose Ave., Los Angeles 46, Cal. **A54-M**

THE LOGAN ARIDIFIER which eliminates the dirt, moisture, oil, fine scale and other pollution that lessens compressed air efficiency is described both pictorially and from an engineering standpoint in Bulletin 543-A issued by the LOGAN ENGINEERING CO., Dept. T, 4901 Lawrence Ave., Chicago 30, Ill. This bulletin contains new tables and data on the discharge of compressed air from $\frac{1}{4}$" to 6" openings with line pressures ranging from 10 to 125 psi. Two pages of charts are shown by which can be determined the exact size of Aridifier necessary to do the job. A large number of installation features showing the Aridifier in forge shops, manganese steel foundries, printing plants, production of Army ordnance, aircraft building and many other applications which appeared in the earlier bulletin are included. **2-M**

SCHAUER SPEED LATHES are illustrated in Catalog No. 440 released by the SCHAUER MACHINE CO., Dept. T, 2076 Reading Rd., Cincinnati 2, Ohio. The revolving of the part to be finished was an entirely new idea in high production finishing as introduced by the Ideal Speed Lathe. The chuck style Speed Lathes, available in single or two speed models or with infinitely variable spindle speeds are particularly suited for use in final assembly departments, in tool and die shops, or in the assembly line where pieces of varying sizes larger than 1" diameter must be handled. **129-M**

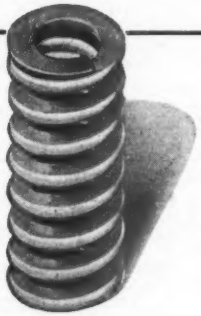
SMALL TOOLS including surface plates, angle plates, sine plates, sine bars and inside micrometers are featured in a 4-page folder

Universal Floating Chucks drill, counter-bore, ream or pilot from a lead hole. Adjustable pressure compensates for tool weight, allows increased feed without causing marred holes. For horizontal operation in screw machines and turret lathes. Write today for further facts about Universal Floating Chucks, Collet Chucks, MIKRO-LOK Boring Bars and Drill Bushings.

UNIVERSAL ENGINEERING
FRANKENMUTH, MICHIGAN

FASTER, FINER DIE WORK

By using the Die Spring Tailored for the Job



WARTIME die work demands greater speed and accuracy. You can meet this demand by using the die spring tailored to the job... and to the press. Customized die springs for each particular requirement are available at Muehlhausen; in series "S" for high speed, "M" for regular speed, and "HD" for heavy duty presses. Over 200 sizes are stocked, ranging from 1 to 15 inches in length, from ¾ to 4 inches in diameter, and from 80 to 3000 lbs. in load capacity.

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Division of Standard Steel Spring Company
875 Michigan Avenue, Logansport, Indiana

WRITE FOR FREE DIE FOLDER!

Illustrates and describes die springs in 206 sizes and types.

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MUEHLHAUSEN SPRINGS

EVERY TYPE AND SIZE

issued by BRAND TOOL & SUPPLY CO., Dept. J, Flower at Washington, Los Angeles 15, Cal. Sine plates have holes drilled and tapped in the upper plate for clamping of work to be checked or machined. Sine bars are used either for measuring angles accurately or for locating work to a given angle within very close limits. **A41-M**

SPOTFACING AND BORING can now be performed in about half the usual time with a B & B Spotfacer and Boring Tool. It provides a wide range of cutting widths, and every spotfacing or boring job can be accurate to a ten-thousandth of an inch, made possible by the micrometer adjustment in the head. This information is contained in Catalog No. 343 issued by the BOKUM TOOL CO., Dept. TD, 14775 Wildemere Ave., Detroit 21, Mich. **A43-M**

A ZURIUM BONDING PROCESS for locking diamonds firmly and securely in the wheel is announced by INDUSTRIAL ABRASIVES, INC., Dept. J, 3724 W. 38th St., Chicago, Ill. Under ordinary care in operation, the new Super Cut Zurium bonded wheels are said to hold up under the toughest applications on carbide tool grinding and finishing. Each wheel is reported capable of grinding several thousand carbide tools, thus cutting time costs and speeding production. A question and answer brochure on diamonds in industry is available. **330-M**

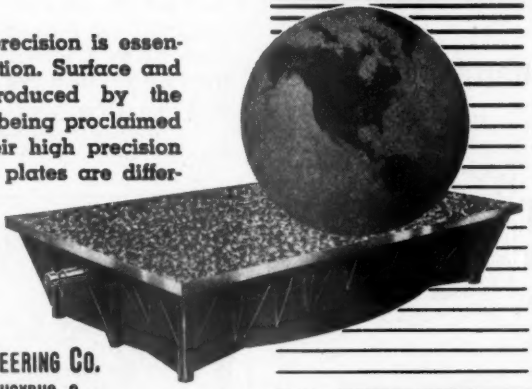
ECCENTRIC DRIVES are featured in an interesting booklet issued by the MORELAND TOOL CO., Dept. J, 16935 W. McNichols Rd., Detroit 19, Mich. Illustrations, specifications, diagrams, and tables of decimal and millimeter equivalents are included. Utilizing the eccentric principle in its design to completely equalize the torque load between the holder and the mating driven cutting member, Moreland has introduced a counterbore drive that is shearproof. **A47-M**

ZIM CUTTER NO. 2, designed to cut one or a hundred rings to very accurate sizes from any coil or spiral packings, is described in an illustrated folder published by the ZIMMERMAN PACKING CO., Dept. D, Cincinnati, Ohio. Asbestos, rubber, duck, cotton, flax, leather, lead, copper and particularly all types of "plastic" packings can be cut quickly and easily. Square butt or beveled butt joint rings can be cut most effectively. Regular beveled and step joints can also be made. The tool weighs only seventeen pounds and can be attached to a bench or easily carried to any location. **A46-M**

WELDING & CUTTING APPARATUS & SUPPLIES are featured in Catalog No. 22B released by AIR REDUCTION SALES CO., Dept. T, 60 E. 42nd St., N. Y. C. For many years

The Future of Our World Depends upon PRECISION

In war or peace, precision is essential to most production. Surface and lapping plates produced by the Smith process are being proclaimed everywhere for their high precision and quality. Smith plates are different! Many sizes available from stock. Write, wire or phone - - - -



SMITH TOOL & ENGINEERING CO.
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Precision —

THE DISTINGUISHING QUALITY OF SOUTH BEND LATHES

It is for their high precision that South Bend Lathes are best known. Their dependable accuracy has made them first choice for the most exacting work in hundreds of essential war production plants. Finish turning and boring operations are often performed with such exactness that subsequent grinding, honing, or lapping is unnecessary.

In war production, there is no place for equipment that can not hold required tolerances or deliver maximum output. Investigate the possibilities of South Bend Lathes for handling your exacting jobs with greater efficiency. With them, you will find it easier to maintain precision tolerances on toolroom and production operations.

POST-WAR PRIORITY PLAN

To those who cannot qualify for a wartime priority, South Bend Lathe Works offers a practical Post-War Priority Plan. You can place your order now for any South Bend Lathe. No deposit or down payment is required. We ask only that the order be placed in good faith. When civilian production is resumed, orders will be filled in the sequence established by the numbers of the Post-War Priority Certificates. Should conditions require, the order may be cancelled at any time.

BUY WAR BONDS NOW... SAVE FOR LATHES

SOUTH BEND LATHE WORKS

LATHE BUILDERS FOR 37 YEARS • SOUTH BEND 22, INDIANA

PUBLICATION PREVIEWS

Airco's activities were confined to the gas welding and cutting field, but they were not slow to recognize the efficiency of electric welding for certain operations. They acquired the Wilson Welder & Metals Co., Inc., a company that had pioneered in the development of the arc welding process. The Airco Style 9803 welding torch, which can be converted easily and quickly into a cutting torch simply by replacing the Mixing Head with the Cutting Attachment, is ruggedly constructed, well balanced, and can be operated for long periods of time without operator fatigue. **A51-M**

GREAVES NO. 2 PLAIN MILLER has the power, material and weight behind it to handle heavy duty production work at fast feeds and speeds and at the same time has high enough spindle speeds to handle small end mill work to advantage. This machine, based on the fundamental principles of design incorporating simplicity with accuracy and precision, is manufactured by the Greaves Machine Tool Co. Every modern feature that has been incorporated in its design is listed. The H. LEACH MACHINERY CO., Dept. T, 387 Charles St., Providence 4, R. I., is the exclusive distributor. **801-M**

REXALLOY CUTTING TOOLS are featured in a 28-page illustrated catalog issued by the CRUCIBLE STEEL CO. OF AMERICA, Dept. T, 405 Lexington Ave., New York 17, N. Y. Facts about Rexalloy, Range of Speeds and Feeds, Rexalloy Standard Ground Tool Bits, Rexalloy Tipped Tools, Max-el Shank Steel for Tipped Tools, Rexalloy Castings, Proper Grinding of Rexalloy Tools, Brazing Rexalloy Tool Tips and Rexalloy Field Engineering Service comprise the Contents Table. Rexalloy, a cast non-ferrous cutting alloy containing approximately 33% Chromium, 44% Cobalt and 17% Tungsten and ranging in hardness from 60 to 62 Rockwell C, is designed for "middle-range" machining applications between high speed steels and tungsten carbides. **256-M**

"GEAR PRODUCTION HIGHLIGHTS"—Vol. VIII, No. 3, published by MICHIGAN TOOL CO., Dept. J, 7171 E. McNichols Rd., Detroit 12, Mich., mentions "Tomorrow's Tractor," Saving Scrap Gears, Versatile Hob Checker, Hardened Shank Reamers and Hobbing Small Gears. The Versatile Hob and Milling Cutter Checker is designed to completely check the correct resharpening of hobs or milling cutters. Initial settings are accomplished by rolling the indicator opposite the ground surface block and adjusing the vertical setting of the indicator. **47-M**

HUOT DRILL INDEX—a drill stand and indexed container with tap information and decimal equivalents—ideal for the mechanics who use hand, electric, breast and portable drills. The No. 60 Index, holding 60 drills, is so compact that it can be carried in the vest pocket. Panels of drills are hinged and fold into the box. This Drill Index is available in nine models to accommodate drills ranging from No. 80 Wire Gauge to one inch. Literature is available from the HUOT MFG. CO., Dept. T, 128 E. 10th St., St Paul, Minn. **A40-M**

WE'RE HOLDING YOUR FREE COPY FOR YOU

THIS new up-to-the-minute bulletin will be one of the handiest reference manuals ever to hit your desk. Here in one spot you'll find, clearly described and illustrated, most of the available Radius Charts, Protractor Charts, Projector Scales and Projector Rules to help you in your optical comparator, shadowgraph and measuring and micro projector work. Your copy is waiting for you; write for it today.

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Safety SUPER-DUTY Set Screw

An unusually strong set screw with all threads die cut — class 3 fit. The sockets are accurately broached, clean and free from grit. The screw is made from special alloy steel, which has been heat treated for maximum toughness, with a tensile strength of 225,000 lbs. to the square inch. The Safety Super-Duty is furnished in any style point shown below.

NATIONAL GRINDING WHEELS

Pay for themselves with longer life, higher grinding speeds and fewer breakdowns. They are investments which pay big returns on production work. Mounted wheels for use in Pattern Shops—Die Shops—Foundries—Auto Body Plants—Plant Tool Rooms—Garages—Rubber Plants—Glass Mfrs.—Textile Mills—Potteries and Home Workshops.

MANUFACTURERS SUPPLY COMPANY
2640 CARNEGIE AVENUE
CLEVELAND, OHIO

PUBLICATION PREVIEWS

PRECISION TOOLS including Vernier, Calipers, Depth Gages and Height Gages, Micrometer Head, Telescope Gages, Glass Surface Plates and Wire Gages are illustrated and described in a pocket-size booklet issued by McGRATH ST. PAUL CO., Dept. J, Fifth & Wacouta Sts., St. Paul 1, Minn. The Gear Tooth Vernier Caliper, a precision instrument used for the accurate measurement of the thickness at pitch line or chordal thickness of gear teeth, and the distance from the top of the tooth to the chord, has two adjustable verniers and is read in one thousandths of an inch, 20 to 2 diametral pitch only. **546-M**

CHAMPION EMERY WHEEL DRESSERS, a circular issued by the WESTERN TOOL & MFG. CO., Dept. TD, Springfield, Ohio, gives the specifications and prices of complete wheel dressers and dresser cutters, sizes No. 0 to 3. The spindle bearings, handles and handle caps are patented—the Champion is the only dresser that runs in an oil bearing. **A55-M**

WET CUTTING BAND SAWS which can also be adapted to existing Johnson dry cutting band saws are illustrated in a folder released by the JOHNSON MFG. CORP., Dept. J, 5000-4 Chrysler Bldg., N. Y. C. Speed-for-speed, wet cutting shows only a slight improvement over dry cutting. However, increased production is achieved because the use of a coolant makes it possible to cut economically at much higher blade speeds than would be permissible in cutting dry. No separate motor for pump is needed because of ingenious power take-off, which also eliminates special wiring and extra switches. **548-M**

LAMINUM SHIMS, composed of brass laminations alternating with layers of metallic binder, are illustrated in a bulletin issued by the LAMINATED SHIM CO., Dept. DJ, Glenbrook, Conn. These shims are the modern choice wherever machine elements are fastened together and which demand adjustments in either production or service. Among these types are shims for bearings, ball-and-socket or slide fits; gear or pinion meshing; preloading or adjustment of anti-friction bearings; positioning, aligning or spacing of all kinds of parts. They can be peeled to the required adjustment, resulting in no filing, grinding or machining. Elimination of gear backlash and eccentric motion are examples of the shim used in the aircraft field. Giant shims for diesel engines, down to instrument shims of fingernail size are used in manufacturing plants in widely diversified industries. Write for detailed specifications of laminated brass shim stock and also information on handy cartons of precision brass and steel shim stock which save time and trouble, prevent waste and protect material in tool rooms, maintenance and repair shops. **354-M**

SPEED REDUCERS are presented in Bulletin 22-27 published by the JANETTE MFG. CO., Dept. D, Chicago, Ill. Mechanical and electrical modifications for motors are given along with specifications and prices. These compact speed reducers provide a practical, simple method for securing low speeds without using chains, sprockets or unsightly gearing. Speed

Grobet

ROTARY FILES

HAND CUT — MILLED CUT
GROUND FROM THE SOLID

There is a Grobet Rotary File, Cutter, Diesinker's Bur in shape, size, and coarseness of cut for every type of hard or soft metal, plastic, wood, etc.

Send for Catalog Y. R. illustrating the complete line in full size, speed charts, etc.

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Heat Treat

Your Own Small Parts...

SAVE TIME AND MONEY THESE 5 DIFFERENT WAYS

This small compact electric furnace is inexpensive, handy and easy to operate—ideal for small tool and die shops—saves time these five different ways:

1. Eliminates delays in sending small machine parts out to overcrowded commercial heat treaters.
2. Saves time and expense of drawing or tempering small metal parts in large furnaces.
3. Cuts handling time when normalizing or annealing small parts. No waiting.
4. Conveniently available for pre-heating for subsequent high-speed hardening.
5. Eliminates shut downs and delays in servicing emergency repair orders.

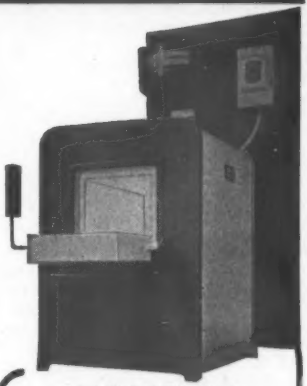
AVAILABLE IN TWO SIZES

Type	*Chamber Capacity*	*Amps 115 V*	*Watts*	*Amps 230 V*	*Price*
MH-3	8″W 6″H 14″L	29.6	3400	14.8	$124.00*
MH-4	10″W 6″H 18″L	....	4800	20.9	$191.00*

**Includes Hearth Plate*

MAX. SAFE TEMPERATURE—Continuous operation, 1750° F.; Intermittent operation, 1850° F.

AUTOMATIC CONTROL—Indicating Controlling Pyrometer—Thermo-couple and lead wire complete—$152.40.



REPLACEABLE HEATING ELEMENTS

Replaceable nickel chromium resistors embedded in rectangular refractory blocks. Elements form inner walls of furnace chamber, and may be replaced easily and quickly after removing rear panel — furnace structure remains undisturbed.

FREE—Complete data covering specifications, additional applications and ordering instructions are included in this new folder. Write for your copy today. Ask for Bulletin No. 50.

COOLEY ELECTRIC MANUFACTURING CORP.
32 SOUTH SHELBY STREET • INDIANAPOLIS 7, IND.

reducers are used for practically all applications where standard motors could be used; dumb waiters, mixing machines, conveyors, machine tools, pumps, stokers, blowers, crushers, agitators, valves, combustion controls, filters, gate hoists, rheostats, voltage regulators, density controls, laundry machines, etc. **340-M**

GEMCO MULTI-PURPOSE SHAPERS. A unique and exclusive feature of all Gemco Multi-Purpose Shapers is the Lubrigard, an automatic safety device, which prevents the operation of the ram in the event of any deficiency in the circulating forced feed lubricating system such as a leak or a drop in pressure below the predetermined minimum. Gemco Shapers are of three designs: Plain, Production and Universal, ranging from 16" to 24" in size. They embody the results of practical experience in the manufacture of such machines extending over almost half a century. They are sturdy, powerful machines built of the very best materials and with greatest precision. Their control and operation is centralized and easily accomplished. Control levers are within easy reach of the operator and dials are extra large and direct reading. Bulletin GC 12 illustrates the several types and sizes and gives the detailed specifications covering eleven models. Bulletin GC 12 is available upon request from GENERAL ENGINEERING AND MFG. CO., Dept. T, 1523 So. Tenth St., St. Louis, Mo. **850-M**

AUTOMATIC WORK DRIVERS are diagrammed and illustrated in Bulletin D-43 issued by the SENECA FALLS MACHINE CO., Dept. J, Seneca Falls, N. Y. These self-centering quick-acting, positive Work Drivers are designed to eliminate dogging time, thus permitting one operator to operate two or more machines. They may be used on any type of Engine Lathe, Multiple Tool Lathe and on Plain or Universal Grinders—in fact, on any machine carrying work on centers and requiring a means of rotation. These drivers have also been used to good advantage on Turret Lathes for driving work mounted on a stub arbor. This method eliminates the necessity of pressing the piece on the arbor. **45**

AIRLOX PNEUMATIC VISES, operated either by synchronizing with the machine or by foot pedal, are described in a folder issued by PRODUCTION DEVICES, INC., Dept. T, Whitehall, N. Y. The Airlox senior, junior and midget vises are illustrated along with their respective specifications. Suggested accessories include foot, hand, cam, check, tri- and speed control valves; quick acting couplers, hose assemblies, control units and compressors. **432-M**

GEARED HEAD LATHES are illustrated in Bulletin No. 40 published by BOYE & EMMES MACHINE TOOL CO., Dept. T, 12 Caldwell Dr., Cincinnati 15, Ohio. Duplication of parts is an outstanding feature of these lathes. Stock parts are supplied for lathes in service 25 to 30 years, and they require no fitting or truing. Speeds are absolutely selective and are obtained from four shifting levers, any one of which can be shifted without regard to the others, with no danger of damage, as no two conflicting gear ratios can be engaged at one time. This eliminates

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with PARKER-MAJESTIC
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For precision grinding . . . internal or external . . . Majestic simplicity of design and flexibility of changeover guarantee maximum grinding output at low cost.
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Representatives in all principal cities
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TOUGHNESS YOU TAKE FOR GRANTED

There are no better symbols of rugged power and tough durabilities than a freight "hog" and the rails on which it runs—unless it's the tough, efficient little tools that drill them.

Celfor tools got their start drilling rails—and have been drilling effectively ever since: are, in fact, frequently chosen for the toughest jobs.

Here, indeed, is toughness you can take for granted. How the Celfor Process preserves and increases the inherent strength and stamina of finest tool steels is well illustrated by the Celfor Type B Reamer, made only by Clark; and equally proved by the Celfor high speed Twist Drill, forged to shape and hot twisted to densify and toughen the metal. No tools can surpass Celfors for cutting qualities and long, useful life. We know—for we make them. A good start toward lower tool costs and faster, easier drilling is to write us for full data.

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BUCHANAN, MICHIGAN

OTHER CLARK PRODUCTS — AXLES (Front and Rear) FOR TRUCKS AND BUSSES • AXLE HOUSINGS TRANSMISSIONS • METAL SPOKE WHEELS • ELECTRIC STEEL CASTINGS • GEARS AND FORGINGS • RAILWAY CAR TRUCKS • BLIND RIVETS • INDUSTRIAL TRUCKS AND TRACTORS

locked out and interference shift devices, and makes ie headstock both simple and fool-proof. **14-M**

SAFETY PLATFORM LADDER—this "Roll-long" ladder, manufactured by the DAYTON AFETY LADDER CO., Dept. J, 2337-2339 Gilert Ave., Cincinnati 6, Ohio, is especially daptable for use in stores, stock rooms, fil-ig vaults, blueprint rooms, stationary stor-ge rooms, libraries, as well as many other milar places. When not in use it can be adily folded or closed and conveniently ored away. It has a broad top shelf upon hich tools and supplies may be placed; so an auxiliary step that can be raised to ve an extra nine inches of safe working eight. This auxiliary step folds back into atform when not in use. **A49-M**

"A STUDY OF FRICTION, GALLING AND EIZING" is the title of Bulletin No. 17 pub-ished by the MEEHANITE RESEARCH INSTI-UTE OF AMERICA, INC., Dept. TJ, Pershing quare Bldg., New Rochelle, N. Y. The book-t contains information developed as a result recent researches into the problems of gal-ng, seizing and scuffing of metal surfaces in ntact with one another. A complete descrip-on of the test methods is included and the st results are charted and conclusions tab-ated. **388-M**

STOP COUNTERSINKS possessing simplified nstruction and cooler running are illustrated a folder issued by AIRCRAFT TOOLS, INC., ept. T, 750 E. Gage, Los Angeles 1, Cal. The simplicity of design and reduced drive shaft area of the Micro-set Stop Countersink eliminate heating. This light weight and compact unit can be disassembled or re-assembled in 60 seconds without the use of special tools. All parts are interchangeable and those, including the stop, which are subject to excessive wear or abuse are made of heat treated alloy tool steel, precision fitted. **178-M**

MISKELLA HY-HEAT UNITS are illustrated in a leaflet released by INFRA-RED ENGINEERS & DESIGNERS, drying, baking, processing and preheating specialists, Dept. TD, 1633 E. 40th St., Cleveland, O. With parts passing through a given Hy-Heat Oven on a conveyor, the heat rays strike diagonally at four points instead of the theoretical two points in 90° construction. With Hy-Heat Units, it is possible to secure temperatures up to 500° F without having to resort to more expensive higher wattage lamps. Because of their modern design it is possible to place them much closer to the product to be heated —even as close as a ½" away, depending only upon the mechanical means used to handle the parts so that they will not strike the sides of a Miskella Hy-Heat Oven. No other Infra-Red Unit will permit the lamps to be set on such close centers. **334-L**

"PACKAGING PAYS OFF!"—Bulletin B6285 issued by the ALLIS-CHALMERS MFG. CO., Dept. J, Milwaukee 1, Wis., describes the Standardized Load Center Unit Substations made by this company. A total of 72 combinations of standard units from 100 to 2000 kva capacity to suit every type of installation is offered and the cost and time saving, ease

C-F POSITIONERS

LESS HANDLING • MORE WELDING

C-F Positioners enable you to do down-hand welding on any part of the weldment, top, bottom, sides—to produce more uniformly perfect welds—stronger joints, smoother, neater fillets and beads which require less grinding. Eliminates handling delays, converts *"handling time"* into *"welding time"*—saves crane service, saves floor space. Table revolves a full 300°, tilts up to 135° beyond horizontal, and is adjustable for height. Models taking up to 30,000 lbs., handle wide range of work, handle larger unbalanced loads. Hand or push button operation. These are universal tools—pedestal or boom mounted to give maximum floor and working clearance.

Write for Bulletin WP—22

CULLEN-FRIESTEDT CO., 1316 S. Kilbourn Ave., Chicago 23, U.S.A.

AMMCO
7" SHAPER

"A Precision Machine of a Thousand Uses"

IT'S PORTABLE

- **Saves time and steps!**
- **Can be moved from job to job in tool and die shop!**
- **Just wheel up to bench--plug in--and go to work!**

On jobs requiring a stroke of 7" or less, the AMMCO 7" PRECISION SHAPER will enable you to save a lot of time and expense in a set-up which would be required for larger shapers. Furthermore, the AMMCO will enable you to get away from the cost of operating a big shaper on small work.

Portable Cabinet model enables this shaper to be moved about the shop.

Write today for specifications and prices

ARMY E NAVY

AUTOMOTIVE MAINTENANCE MACHINERY CO.
2100 Commonwealth Ave.—North Chicago, Illinois, U. S. A.

of installation, flexibility and other advantages are pointed out. Construction features and engineering data are comprehensive. **183-M**

"AIR PROCESSING EQUIPMENT" is the title of a new catalog released by PETERS-DALTON, INC., designers, engineers and manufacturers of industrial equipment and complete air processing systems, Dept. T, 628 E. Forest Ave., Detroit 1, Mich. This 56-page book shows many installations of their dust collecting units and systems, spray booths and equipment, ovens and ventilating and completely engineered air processing systems. It tells an interesting story of the Peters-Dalton complete engineering facilities, and includes detailed specifications of Hydro-Whirl Dust Collectors and Spray Booth units together with engineering data of great value to those having air handling problems. **672-M**

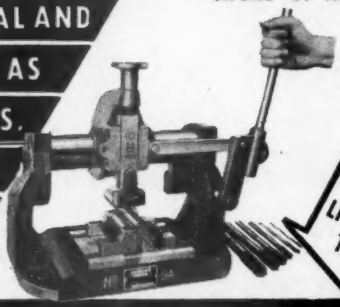
MACHINE TOOL ACCESSORIES are featured in an illustrated booklet issued by IDEAL COMMUTATOR DRESSER CO., Dept. J, 1290 Park Ave., Sycamore, Ill. Their "A.C." Magnetic Chuck, Triple-Duty Live Centers, "Etcher-Demagnetizer", "Machine Shop" Metal Etcher, Portable Demagnetizer, Electric Tachometer, Grinding Wheel Dresser, Balancing Ways, Variable Speed Transmission and Electric Cleaners are fully described. The Ideal "True-Dress," made of selected abrasive materials, gives a cutting and truing effect almost equal to that of a diamond. This grinding wheel dresser is recommended for form grinding and restoring wheel balance. **329-M**

"DETROIT" TAPPING MACHINE—A six-page, 4-color folder, Bulletin LTM-44, describing their improved light duty tapping machine has been issued by Detroit Tap & Tool Co. A detailed description of this machine, which has been specifically designed for precision tapping in production, is given. There is also a cutaway view of the machine in silhouette with the main parts plainly numbered. Also included is a detailed list of specifications among which are standard spindle speeds of 64, 160 and 400 rpm; a maximum clearance from tap holder to surface of work table of 19 inches; and the machine's capacity which is rated up to a maximum of ⅞" diameter and 14 pitch in mild steel. Duotone reproductions of the light duty tapping machine, together with line drawings and photographs, fully illustrate the features, improvements and special applications of this machine. This bulletin is available from the DETROIT TAP & TOOL CO., 8432 Butler St., Detroit 11, Mich. **134-M**

MILLING MACHINES AND ATTACHMENTS are illustrated and detailed in a catalog and price list issued by the BURKE MACHINE TOOL CO., Dept. J, Conneaut, O. These tools are built to a high degree of accuracy and, as no weight has been sacrificed, they will perform any work within their size range. All screws have graduated dials, graduated in .001. Motors are mounted low on the column and to one side which makes them extremely convenient for the changing of speeds. **661-M**

THE ACROMARK No. 9A MACHINE
IS ESPECIALLY DESIGNED FOR
MARKING OF CYLINDRICAL AND
TUBULAR PARTS SUCH AS
TAPS, DRILLS, END MILLS,
MACHINE PRODUCTS, ETC.
WITH PERFECT RESULTS

A part is marked at each forward and each backward stroke of the lever



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Available in power driven units with new style clutch

ACROMARK
MARKING AND STAMPING SPECIALISTS
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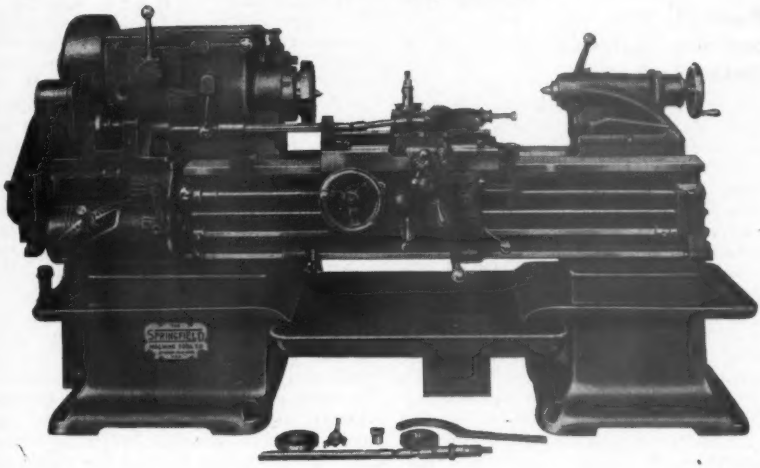
SPRINGFIELD PRECISION LATHE

Out in front!



● Headstock . . . twelve speeds . . . only half of the easy-shifting spur gears mesh at one time.

Motors . . . V-Belt or silent chain drive.

Bed . . . permanently true—made of high test alloy to resist warp or marring under severe service.

Apron . . . extra heavy—operates on Ball and Bronze bearings throughout.

Taper attachment . . . hair-trigger adjustment.

Compound rest . . . sturdy, firm.

Tailstock . . . all bearings and bed ways oiled from one well.

From headstock to tailstock—the SPRINGFIELD Lathe is *out in front!*

SEND TODAY FOR BULLETIN No. 163

Tells the why and how of Springfield's accurate production.

THE SPRINGFIELD MACHINE TOOL CO.

SPRINGFIELD • OHIO, U. S. A.

(CONTINUED FROM P. 144)

Westinghouse Nuttall Works Receives National Security Award

The Nuttall Works of the Westinghouse Electric and Manufacturing Company has received the National Security Award for developing superior safeguards against fire, sabotage, enemy air raids and avoidable accidents, Louis R. Botsai, Manager of the plant, reported. The award was made by The U. S. Office of Civilian Defense after The Nuttall Works, Westinghouse's Gear Manufacturing Unit, was nominated for the honor by regional civilian defense headquarters in Baltimore. Colonel Henry H. Reninger, Acting Director of the Third Civilian Defense Region, presented the award which was accepted by Captain G. L. Kay, chief of the Plant Protection Department. Colonel Reninger praised the plant protection record set by the Nuttall Works and told George H. Bucher, president of Westinghouse . . . "The award indicates a fine spirit of cooperation of management and employees beyond the call of routine duty."

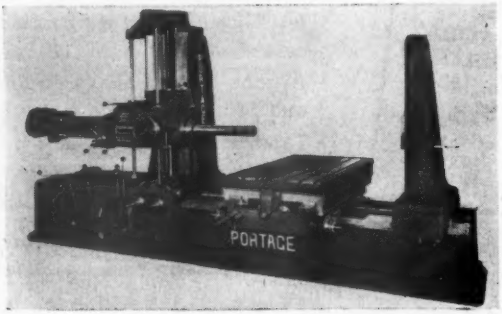
Accident Rate Cut

A cut in the accident rate of the Westinghouse Electric and Manufacturing Company last year by five percent, in the face of an increase of almost 50 million man-hours of labor and the employment of thousands of new and inexperienced workers was reported by H. B. Duffus, safety engineer. He revealed that the lost time accident rate for all of the company's 27 manufacturing plants and repair shops for 1943 was less than 5 per million hours of work as compared with 5.2 for the previous year. The ingenuity of the man on the job played a big part in "holding the line" against industrial mishaps, Mr. Duffus reported. He cited the contribution of one veteran workman who devised a hazard-proof guard for large punch presses. Formerly, the guards used on these machines were solid pieces of metal placed in front of the dies. Although they ordinarily prevented the operator from placing his hand under the die, they also blocked his vision of the piece of metal he was stamping. As

PORTAGE

4 INCH BAR HORIZONTAL BORING, DRILLING & MILLING MACHINE

ROTARY TABLES



ACCESSORIES

● Designed and built to meet the need for speed and accuracy demanded of today's production.

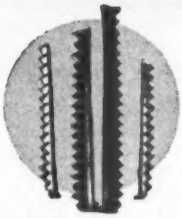
WRITE TODAY for fully illustrated bulletin giving detailed description of the many features of this Horizontal Boring, Drilling and Milling Machine. No obligation.

THE PORTAGE MACHINE COMPANY

555 Miami Street, Akron 11, Ohio

It is NOT NECESSARY to SCRAP

A MACHINED PART BECAUSE OF IMBEDDED BROKEN TOOLS



When a tap or other tool breaks off in a work part that is being machined, it may be removed by the Elox method without effecting the threads which have already been cut or the surface metal of the hole.

It is done by electrical disintegration using a low voltage, high amperage current with a constant flow of cooling water at the contact end of the electrode. The unit does not revolve. A 110/115 volt 50-60 cycle alternating current outlet and a convenient supply of tap water are all that is needed for the Type E. Disintegrator. The Type H Disintegrator includes its own coolant supply system.

The Elox method is also used to "drill" holes of various shapes in hardened dies and machine elements without annealing.

Write for Technical Bulletin and Specifications

CORPORATION **ELOX**

3-252 GENERAL MOTORS BLDG.
DETROIT 2, MICHIGAN
Plant—18273 LIVERNOIS AVENUE
DETROIT 21, MICHIGAN

a result there was the potential hazard of the operator sliding his hand over the guard and under the die to remove a defective piece. A new type guard was developed by Andrew Mitchell, a veteran of 20 years service with the company, which consists of a series of thin round bars placed in front of the die. The bars are spaced far enough apart to allow for accurate vision of the metal being worked, but at the same time are close enough to make it practically impossible for the worker to place his hand under the die. "The guard has been in use now for almost a year and not even a pinched finger has been reported from machines using it," Mr. Dufus said.

Allis-Chalmers' Gas Turbine Division

Creation of a new Allis-Chalmers research and gas turbine development division has recently been announced by R. C. Allen, Manager of the Company's steam turbine department. Dr. J. T. Rettaliata has been appointed manager of the new division. Having built more than 30 gas turbine units for oil refineries, Allis-Chalmers has operating experience on more prime mover types of gas turbines than any other American company. In directing this work, Dr. Rettaliata is applying a broad background in this field. His work largely in the development of the gas turbine has earned for him annual awards from national engineering and scientific societies for the past three years. He received his doctor of engineering at Johns Hopkins University in 1936. Assisting Dr. Rettaliata is J. L. Ray, Chief Engineer in gas turbine development.

Industrial Safety News

A multiple attack on industrial accidents is being made by the Greater New York Safety Council. Their Safety Training Course for foremen and a six-month inter-plant accident reduction contest are promoting safe operations on the job, and a Home Safety Campaign is helping with off-the-job accident prevention. The contest, one of the largest in the country, involves 251 industrial plants employing 162,000 workers.

VALUABLE BOOKLET AVAILABLE

Forgings For All Industries
Rough Turned or Finished Complete

Composite Die Sections • Extrusion Tools • Crankshaft Forgings • Gear Forgings • Die Casting Dies

Rings, Discs, Blocks, Shafts, Hubs, Bars, and Special Shapes.
Tool Steel of all Makes

S.A.E. and NE Specifications
STAINLESS & COPPER FORGINGS

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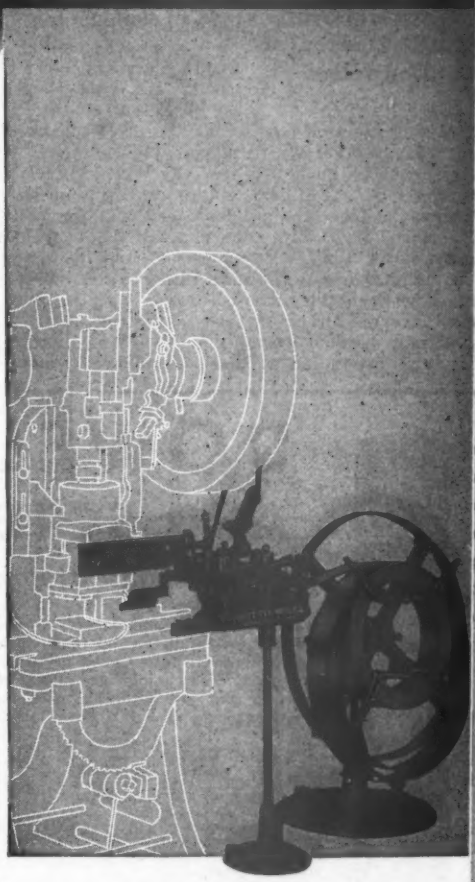
AJAX STEEL AND FORGE Co.
205 ADAIR STREET DETROIT, MICHIGAN

Our Punch Presses Are More Flexible And Productive With WITTEK *Automatic* Roll Feeds And Reel Stands



Manufacturers of metal stampings facing problems in the feeding of coiled strip stock to punch presses will find that Wittek Automatic Roll Feeds and Reel Stands conserve man-hours and achieve new high production levels.

Providing an improved and simplified method of punch press operation, Wittek Automatic Roll Feeds and Reel Stands insure rapid, safe and accurate feeding under all conditions. Made in four different types to meet all automatic feeding requirements. Write for complete details. Wittek Manufacturing Co., 4305-15 West 24th Place, Chicago, Ill.

ARMY E NAVY

WITTEK WMCo *Automatic*

ROLL FEEDS and REEL STANDS

For All Makes and Sizes of Punch Presses

Total accident exposure is estimated at 200,000,000 man-hours for the six months' period. The Safety Training Course for foremen opened recently with 177 employees representing 70 different firms present.

Static Electricity Controlled

Officials of two of the nation's largest tire makers, disturbed by fire hazards caused by static electricity in one process of synthetic rubber tire manufacturing, recently asked advice of Westinghouse engineers on how to lick the problem. G. W. Penney, Manager of the Electro-physics department of the Westinghouse Electric and Manufacturing Company's Research Laboratories at East Pittsburgh, Pa., came up with the best answer that has yet been found, i.e., impregnating the canvas cloth rolled between the cotton or rayon tire cord layers. Other methods, such as artificially created humidity in the factory and grounding of the machinery, proved insufficient or have interfered with the efficiency of the manufacturing process. Mr. Penney recently explained his solution of the problem to members of the rubber section of the Ohio Safety Congress.

Radio Waves in Industry

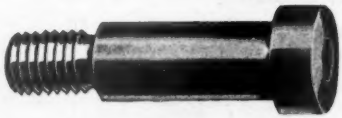
"Use of radio waves to flow metals on surfaces is only one of approximately 50 major induction heating applications of electronics which Westinghouse believes will be used widely after the war," D. D. Knowles, Manager of Electronics Engineering for the Westinghouse Lamp Division told industrialists and management men attending the Fact Forum of the Industrial Marketers of New Jersey.

"The electron, tiniest particle of matter known to man, is the 'work horse' of wartime industry. Electronics—in all its multitude of uses—is a determining factor in winning the war, not merely a science of the future," said the inventor of the "Grid-Glow" tube, first practical member of the family of oddly-

DOWEL PINS
AND SCREWS
for Immediate Shipment . . .

We can give you good delivery on DIE-CO Precision Dowel Pins. Just tell us your requirements . . . and your worries are over! DIE-CO Dowel Pins are the finest you can buy. Ground to tolerance of plus or minus .0001". Standard pins ground .0002" over listed diameters, over-size pins ground .001" over listed diameters.

All standard sizes of Socket Head Cap Screws and Hollow Set Screws CARRIED IN STOCK for your convenience. PLATING AND RUSTPROOFING: We can save you time by handling the rustproofing, plating or "parkerizing." Just include specifications on your order. We'll do the rest and bill you the usual extra charge.



DIE SUPPLY COMPANY
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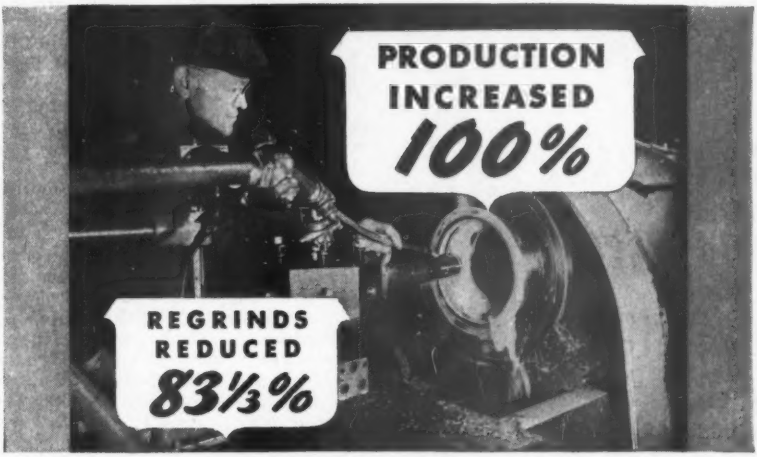

"HARDSTEEL" TOOL BITS

Outperformed all other tools on this difficult machining job

Drill steels hardened by any method without annealing. You harden it—we'll drill it.

Many plants have reported the outstanding performance of "HARDSTEEL" tool bits—the following is typical. Production of aerial torpedo tail cones from SAE 3150 steel forgings bored on a 96-inch lathe running at 126 ft. per minute and taking a .250 in. cut at .012 in. per rev. feed was three a day. Seven cuts were required,—with 3 regrinds per piece, using a high grade tool.

After changing to "HARDSTEEL" tool bits the feed was doubled to .025 in. per rev.—regrinds were cut to 3 per day and output increased to six tail cones per day.

"HARDSTEEL" tool bits are cast from a special alloy, the same material that enables "HARDSTEEL" drills to drill hardened steels without annealing. They are economical on tough, hard steels, scale covered forgings and the tough, abrasive copper and light metal alloys.

Let "HARDSTEEL" help you turn out more work at lower cost. Outline your tool problem—or ask for a copy of the "HARDSTEEL" Operators Manual.

BLACK DRILL CO. • Division of BLACK INDUSTRIES
1400 EAST 222nd STREET • CLEVELAND 17, OHIO

"HARDSTEEL"
DRILLS · TOOL BITS · SPECIAL TOOLS

named gas-discharge type of control tubes.

"Electronic devices make possible the large-scale production of magnesium and aluminum and permit power lines to carry more electricity. Through electronics, we can look into a massive slab of armor plate to spot flaws beneath the surface; we can analyze the complicated gasses used in making synthetic rubber.

"Industrial electronics is growing fast and is today a large industry. Probably $500,000,000 worth of business has been done in the industrial field in the last three years, excluding radio and communications. This makes it a big business even today.

"Of course, there's something mysterious about electronics—just as there is about any natural phenomenon. But it is no mere catch-word designed to conjure up visions of a dream world after the war. The science of electronics is built on a firm foundation.

"Because we know how to separate the electron, a speck of negative electricity, from its home in the atom, the tempo of wartime production has been tremendously increased. The acceleration is especially pronounced in magnesium and aluminum plants where an electronic tube called the Ignitron has played a leading role." Without moving parts, the Ignitron converts alternating electric current into direct current required for production of these two metals.

A new synthetic resin, Fosterite, a solventless impregnant that gives 100 percent fill for insulation in coils and apparatus and is a very efficient moisture-proofing material, is announced by the Insulating Department, Westinghouse Research Laboratories. Fostorite, in liquid form, is applied to the coil or device. The "solvent" reacts with another resin dissolved in it and the whole mass turns to a tough solid. It is solventless in that the whole of the liquid resin reacts under heat to form an infusible solid; there are no by-products of the reaction that must escape.

Fosterite

The complete filling allows much higher voltage gradients. On one small radio transformer Fosterite provided 4 to 5 times the dielectric strength obtained with former materials. Experiments indicated that coils impregnated with Fosterite dissipated as much as one-fourth more heat than coils impreg-

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BORING
BARS
Universal Mikro-lok Boring Bars are designed for finishing cuts where extreme accuracy is required. For jig boring, diamond boring and screw machines. Especially adapted for boring to a shoulder, or to the bottom of a hole or where intermittent cuts are being taken. Extremely rigid. Easily and quickly adjusted like a micrometer to limits of .0005 or less. Available singly or in sets. Write for facts and prices.
UNIVERSAL ENGINEERING
FRANKENMUTH,
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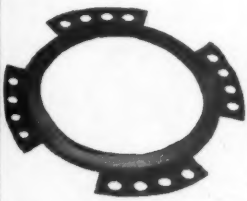
Chrome Plating *used to be* Decorative too!



Unusual aircraft machine part salvaged by Hartford Chrome.

Like the bathing beauty who is now welding on the Swing Shift, chrome plating has gone in for sturdier pursuits. Matter of fact, its wartime improvements have come so fast, the question is *"Have YOU kept up?"* Salvage by plating is one-half the story. The other half is the brilliant record of hard chrome plate on the production line, prolonging the life and increasing the efficiency of tools, dies and molds. If you're responsible for production or maintenance you want the up-to-date facts on hard chrome plate. Write for them today.

Typical gage jobs being plated every day by Hartford Chrome.

Valuable "Show-How" Literature

Concise, important information for Tool Engineers, Plant Managers, Foremen, Purchasing Agents, etc. A request on your letterhead, and it's yours, with our compliments.

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nated with solvent-type varnishes. Tests also indicate that Fosterite is insoluble in transformer oil. Moisture proofing tests indicated a radical improvement with Fosterite coating and impregnation, moisture proofness is 100 to 1000 times better than by the use of the best previous materials according to the manufacturer.

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By the process poplar, for example, becomes harder than hard maple, which in turn can be made harder than ebony. The softer woods can be transmuted to serve many structural purposes formerly impossible. The range of manufactured articles as veneers, flooring, mill work, kitchen, laundry, sanitary ware and chemical equipment now possible with transmuted woods is very great. Many woods can be used as substitutes for metals.

Methylolurea is the chemical agent utilized. It is compounded of dimethylolurea and urea; both white, water soluble solids and both inexpensive chemicals now being produced on a large scale. Both materials are on allocation by the WPB, but are available in small test quantities without formal allocation. The methylolurea is impregnated into the structure of the wood in a water solution. Methylolurea reacts with components of wood to form hard, water-insoluble, unmeltable resins within the wood structure. Natural wood acids initiate the reaction. The conversion of the methylolurea into resins is completed by air or by kiln drying, the latter speeding the process. No new type of equipment is involved in the treating installation.

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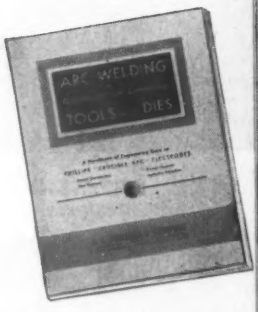

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nd BOOK REVIEWS

BROACHES AND BROACHING. The purpose of this volume, which has been brought out by the Broaching Tool Institute, a nation-wide organization of broaching tool manufacturers, is to bring to American industry a comprehensive discussion of broaching practice, to call attention to the very rapid recent progress in the broaching field, and to emphasize the application of broaching to both war and post-war production. The Broaching Tool Institute is in an exceptional position to sponsor such a volume since the purpose of the Institute is to compile standards, encourage research, and foster the progress of broaching for the benefit of the industry at large. The basic data which forms the basis of this book was chiefly contributed by the engineering staffs of the broach manufacturers who are members of the Institute. The principles outlined and the examples and practical applications cited are taken from the first-hand experience of highly qualified engineers in their daily contact with broaching problems.

A concise idea of the contents of the book may be obtained from a listing of the chapter headings: History of Broaching; Advantages, Applications, Limitations of Broaching; Types of Broaches; Broach Cutting Action; Material to be Broached; Broach Design; Information Needed for Design and Manufacturing of Broaches; Broach Cost Factors; Handling Broaches; Sharpening Broaches; Broaching Machines; Setting Up the Broaching Machine; Fixtures; and Cutting Fluids.

Broaches and Broaching is published under the auspices of the Broaching Tool Institute, 74 Trinity Place, New York 6, N. Y., and is priced at $3.00.

MICARTA DATA BOOK, a new edition of the engineering data available on Westinghouse's industrial plastic for heavy-duty-service, is an excellent presentation of the complete technical facts about Micarta—designed by Westinghouse as the "steel" of the plastics field. In addition to a list of the uses of Micarta with reasons for its selection and a section on its manufacture, the three main sections of the book give grade selection tables and complete stock data on the laminated Micartas, the molded Micartas and Micarta "444", a cotton cloth sheet impregnated with phenolic resin for forming or shaping parts. There is also a brief but unusually good section on machining data. The chart material, particularly that showing representative curves of stress-strain diagrams of laminated and molded grades of Micarta and chemical properties of the same Micartas is unusually good. There is also a design check list and design suggestions for molded Micarta that will be welcomed by plastics mold designers. A copy of the 40-page Micarta Data Book will be sent on requests directed to Westinghouse Electric and Manufacturing Co., Micarta Division, Trafford, Penna. **35-M**

SPEED CASE AND SPEED TREAT PLATE, this handsome 32-page, two color bulletin published by W. J. Holliday & Co., Hammond, Ind., is both a treatise on these two carbon steels plus an unusually complete pictorial representation of a wide number of actual applications. Speed Case is a low carbon, open hearth, free machining steel produced by several mills under processes and analyses patented by the Holliday Company; Speed Treat is a medium carbon, open hearth, high tensile, free machining steel, also produced under Holliday patents. The tables, charts and formulas are tied in to actual applications by means of excellent photographs and details of fabrication and production results. The properties of Speed Case, including excellent impact resistance, notable torsional values, high case hardness, unusual ductility and minimum distortion make this steel a high priority choice for such applications as mechanical rubber molds, injection molds, metal forming dies, jigs and fixtures, bolster plates and many other structural parts. Speed Treat has a wide range of uses because of its tensile strength, free machining and hardness. Both these steels are helping the war effort through the reduction of machining and carburizing time. For a copy of "Speed Case and Speed Treat

Plate make a request on your company letterhead. **321-M**

INDUSTRIAL PLASTICS, the second edition of this excellent survey, covers many of the new types available and discusses their applications. Wartime developments in plastics are treated. After introductory chapters on basic materials and a discussion of ten important plastics, there are meaty, comprehensive chapters on molding, fabrication, physical properties, plant equipment and design. A chapter on industrial applications should be especially helpful to the student and the experienced mold shop operator alike. There is a fund of general and background information in chapters designated "Plastics and Metals", "Chemistry of Plastics", "Foreign Practice", "Texture of Plastics" and "Plastics Trade Names and Trademarks". The material is well arranged for study or reference and the numerous illustrations are well chosen. The book by Herbert R. Simonds, Consulting Engineer and Technical Editor of "Plastics World", is written in a lucid, straightforward style with the practical needs of designers, molders and fabricators in mind. It remains one of the best general reference books on the whole field of plastics. "Industrial Plastics" is publishd at $4.50 by Pitman Publishing Corporation, 2 West 45th St., New York, New York.

WELDING AND CUTTING SAFETY STANDARDS. It is a well known fact that the welding and cutting industry, ever since its inception, has always been several steps ahead of industry in general in matters of safety. Further concrete evidence of this alertness and leadership in the safety field is shown by the publication of an attractive 32-page booklet entitled "Safey in Electric and Gas Welding and Cutting Operations". This is another in the series of American War Standards developed by the American Standards Association. Its preparation was initiated by the International Acetylene Association, the American Welding Society, the National Electrical Manufacturers Association and the Division of Labor Standards of the U. S. Department of Labor. This booklet is designed to serve as a guide for protection of the individual operator from injury or illness, and for the protection of property from fire or other damage arising out of improper methods in the installation, operation, or maintenance of welding and cutting equipment. It covers every phase of safety applicable to all ordinary welding, cutting, brazing, lead burning, and flame-treating operations. It does not attempt to cover any special hazards which may be inherent in the operations of special industries such as explosives manufacturing or shell-loading. The booklet is interestingly written and is well worth studying.

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using an optical flat, a toolmakers flat and a gage block

The formula is:

$$D = h + \left(.000012 \times N \times \frac{W}{w}\right)$$

Substitute the actual values

$$D = .750 + \left(.000012 \times 3\tfrac{1}{2} \times \frac{1\ 7/16''}{23/64''}\right)$$

and get the answer

D = .750168 inch.

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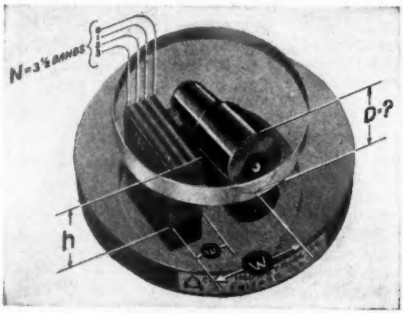

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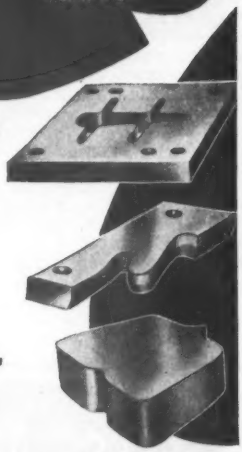

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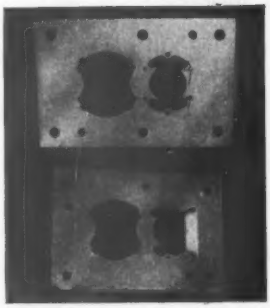

For Die Repairs Also—*Upper photo shows a die broken in service. Lower photo shows how die was prepared for insert with No. 1 Profile Grinder.*

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Published by the American Standards Association, 29 West 39th Street, New York 18, N. Y., single copy price 40 cents. Quantity prices available.

"THE MIDDLE OF THE SHOP" is the intriguing title of a newly announced, pocket-size booklet, written by Tom Saffady of Sav-Way Industries, Detroit precision manufacturing concern. It is addressed "to production men who still like to get their hands dirty". In Saffady's distinctive, dynamic style this brochure presents a new slant on the well-worn philosophy that the folks in the "Middle of the Shop" represents a tremendously potent source of information and a fertile field for the development of labor-management relationships which can have an important affect on production efficiency. Saffady recommends that if management will take the trouble to get really acquainted with its workers, it will be surprised at the results. Ted Nagle, Sav-Way sales manager, reports that the company has had more than a thousand requests for this booklet. It contains no advertising and is available without cost by addressing, Dept. TD, 4875 E. Eight Mile Rd., Detroit, Mich. **16-M**

ENGINEERING INSPECTION PRACTICE, by A. T. King, A.M.I.E.I. This is a complete guide to the methods, gauges, and instruments used in the engineering production workshops. It treats of the reading of working drawings, limits and tolerances, linear and angular measurement, the mathematics of measurement, measuring tools, the measuring of screw threads and gears and precision measuring, engineering materials and hardening processes, testing of metals and hardness, aeronautical inspection, etc. It is written in an unusually clear fashion and is an excellent text upon which to base a course in inspection practice.

This new book is particularly important to the sub-contractor and small manufacturer who now employs methods previously limited to large-scale manufacture. It is important to the thousands of individuals who are training for specific jobs of inspection as well as those who have the talent and ambition to complete training in ALL the methods of engineering inspection. In these days of high-speed precision production, no one engaged in manufacturing can afford to be without this book.

Published by the Chemical Publishing Company, Inc., 236 King Street, Brooklyn, N. Y., and priced at $3.00.

SUCCESSFUL SOLDERING, by Louie S. Taylor, Assistant Professor of Industrial Arts Education, Santa Barbara State College. The process of soldering is used perhaps more

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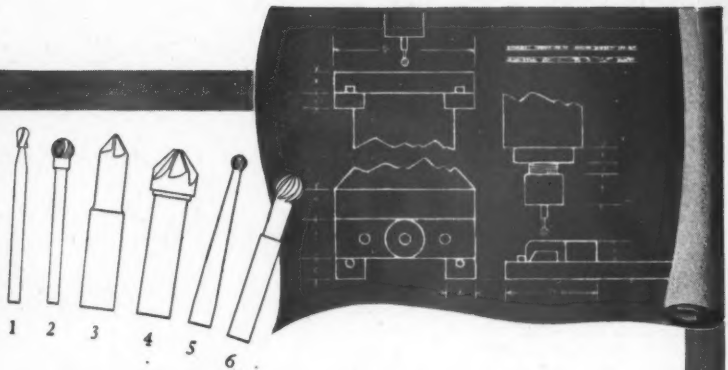

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often in more kinds of trades and crafts than any other simple method of joining metals, and yet it is often performed incorrectly. In the preparation of this book an attempt has been made to treat the subject in a clear, concise, and understandable manner and to give the necessary directions and instructions so that the least experienced person can learn to solder.

This practical book shows fully and plainly how to get good results in soldering of all types. It covers the fundamentals of the process, then takes up in detail the various types of soldering coppers and solders, showing the purpose and correct uses of each. It then covers the special problems of soldering various metals such as black iron, zinc, tin, stainless steel, copper, aluminum, pewter, brittania metal, and lead, each being covered in separate chapters.

Many clear illustrations are included that will be helpful and valuable as a source of ready information, and the data given will aid the experienced workman in choosing the right materials and methods for any special soldering work he may encounter.

Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 18, N. Y., and priced at $1.00.

THE OXY-ACETYLENE HANDBOOK, published by The Linde Air Products Company, fulfills an urgent need, long felt by both student and experienced welding operators, for a complete, comprehensive, and authoritative textbook on basic oxy-acetylene welding and cutting procedures. This new, durably bound, 600-page manual is invaluable as a guide for self-instruction and also as a standard classroom textbook in vocational and trade schools, technical high schools, and engineering colleges. It covers the entire range of the oxy-acetylene process, giving clear, easy-to-follow instructions for handling all the common commercial metals, together with simple explanations of the fundamental principles of the various methods of depositing and controlling molten metal. Considerable space is devoted to an explanation of the operating principles of the oxy-acetylene equipment and instructions for its care and maintenance.

In addition to its use as a textbook for teaching students how to weld and cut, of teaching experienced operators how to improve their welding and cutting, THE OXY-ACETYLENE HANDBOOK will also serve as a guide and authoritative reference book for plant management people, engineers, designers, superintendents and foremen in shops where oxy-acetylene welding and cutting is used or might be used as either a production or a maintenance tool.

This is a how-to-do-it book. A few of the many subjects covered are: how to set up, operate, and care for oxy-acetylene apparatus; what flame adjustment to use and how to use it; how to identify metals; how to weld steel, cast iron, malleable iron, galvanized iron; how to weld aluminum, copper, brass, bronze, nickel, Monel, lead, magnesium; how to bronze weld; how to

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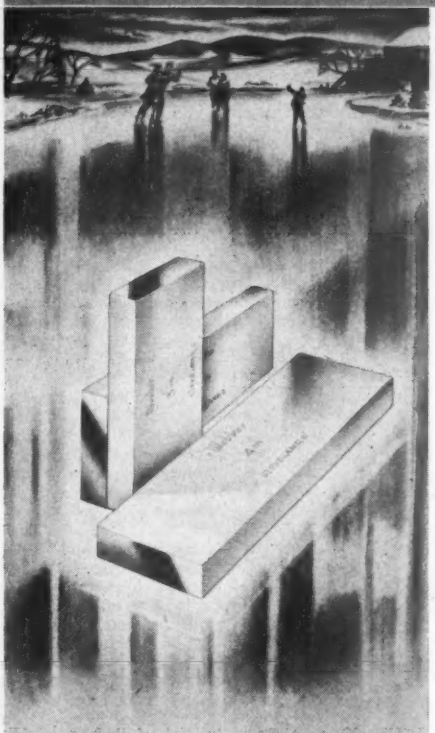

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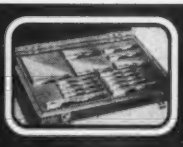

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THE OXY-ACETYLENE HANDBOOK, price $1.50, may be purchased at technical book stores, or at any sales office of The Linde Air Products Company.

THE EXTRUSION OF METALS, by Claude E. Pearson, M. Met. (Sheffield), Head of the Metallurgy Department, King's College, University of Durham.

This is a most outstanding book devoted to an art in which there is a widespread and increasing interest and at the same time a paucity of readily available literature. Quoting from the Foreword, written by R. Genders, M.B.E., D. Met., Superintendent, Technical Applications Metals, Ministry of Supply: "The process of extrusion has achieved within a short period a major revolution in methods of metal working, and its advantages are now felt in the economy of production of non-ferrous metals and alloys in many forms. There has been for some time a need for authentic information on the subject, but it is only during the last twenty-five years that investigations have been made to gain the information necessary to link up the engineering and metallurgical aspects. The present book is, therefore, not premature, yet it could hardly have been written with adequate effect any earlier. Those who have worked on the subject will be foremost in acknowledging the high credit due to Mr. Pearson for completing the achievements of his own work by this full treatise." Because of the pioneer nature of the author's work in collating the information on the state of the art of extrusion he has incorporated an historical background that is appropriately pertinent to, and which, in a most welcome manner, enhances, the technological presentation of his subject. The author has avoided offering a mere description of plant and procedure by introducing theoretical aspects where possible. With this object, chapters have been included to deal with flow phenomena in the process; and with factors, such as temperature, the speed and extent of deformation, etc., in their influence on the extrusion of metals. In regard to this, the author has drawn, besides his own experiments, upon the important investigations carried out in Germany. The subject of impact extrusion tends to fall into a class by itself, and has received separate treatment. Some space has also been given to those specialized methods of extrusion which form a connecting link between it and forging. In addition to the historical and theoretical treatment the book is the essence of practical "know-how" and should soon become well worn in the hands of anyone having to do with the extrusion of metals. Particularly as related to post-war planning this text should enjoy widespread distribution among, and enthusiastic reception by, plant metallurgists, product

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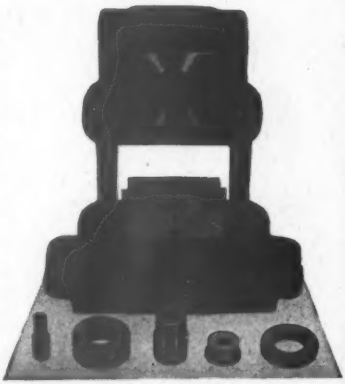

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designers and tool and methods engineers. At the same time the author's style and thoroughness in developing his subject results in a text of invaluable aid to the engineering student and learner. The scope of the work can best be conveyed by the main chapter titles: Historical Survey; The Extrusion of Lead and Other Soft Metals; The Extrusion of Lead Cable-Sheathing; Equipment for the Hot Extrusion of Hard Metals; Flow in Metals During Extrusion; The Pressure of Extrusion; Metals and Alloys for Hot Extrusion; The Properties of Extruded Metals; The Impact Methods of Extrusion and Some Special Applications of Extrusion.

The book is of 205 pages and can boast of a high caliber of line drawings, photographs, charts and diagrams.

Published, 1944, by John Wiley & Sons, Inc., Dept. TD, 440 Fourth Ave., New York City, and priced at $3.75.

INDUSTRIAL MANAGEMENT by Asa S. Knowles, Dean, School of Business Administration, Rhode Island State College; formerly Dean, College of Business Administration, and Head, Department of Industrial Engineering, Northwestern University AND Robert D. Thomson, Associate Professor of Industrial Management, Northwestern University; Owner and General Manager, Thomson Mfg. Co., The A. E. Liebsch Co., and The F. R. Benner Co.; formerly Management Consultant.

This new book should prove highly useful to students of industrial management, whether they are actively engaged in the management of industrial enterprises or learning the fundamentals for the first time. The text and problem materials contained in this book have been used effectively in teaching industrial management to students of business administration, engineering and liberal arts.

The text differs from others on industrial management in four respects as follows: 1. Scope. The subject matter is confined to topics of immediate and vital concern to persons who must direct the work of others in manufacturing enterprises. 2. New Material. A considerable portion of the subject matter presented has not appeared in organized textbook form prior to the publication of this volume. This is particularly true of the parts dealing with the management of Physical Property, Production Control and Cost Control. 3. Unit Treatment. In recognition of the fact that all topics of industrial management are closely related, the entire book has been organized so that the related aspects of any one topic in the field of industrial management are presented as a unit. For example, the subject matter of motion study is treated in two separate chapters; one chapter discusses the principles of motion study as they pertain to the organization and layout of the physical plant, in Part III, and the other Chapter as they pertain to the effective use of Manpower, in Part IV. 4. Problems. Each of the six main parts of the text is followed by problems which require solution.

The book is profusely illustrated by photos, drawings, charts and forms and is published by The Macmillan Co., Dept. TJ, 60 Fifth Ave., N. Y. C. Price, $4.50.

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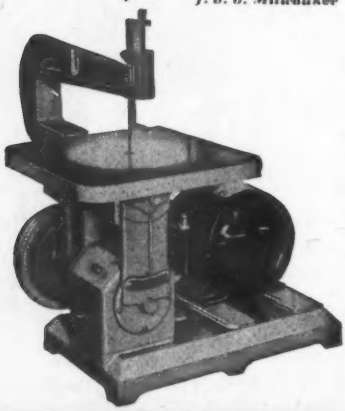

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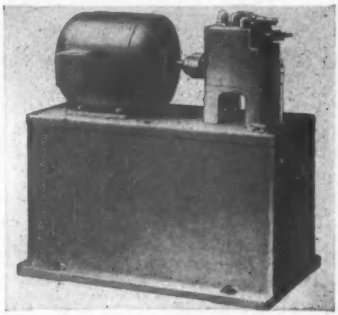

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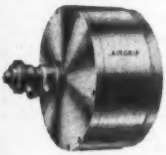

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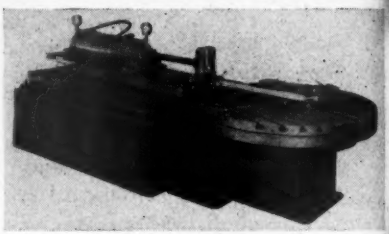
AIR ENGINEERING EQUIPMENT

Bath Universal Rotary Stretcher

The Bath Universal Rotary Stretcher is announced by The Cyril Bath Company, Dept. J, East 70th and Machinery Ave., Cleveland 8, Ohio. The new unit can be used for wiping, rolling or stretching and for some machine operations in the manufacture of its own dies. Other uses are in development since the unit has numerous potential applications.

The illustration shows a Bath Universal Rotary Stretcher forming a tank strap in which the leg of the angle must stay in the horizontal plane, while the



flange changes in angularity as much as 15° from end to end.

The Bath Company has developed a semi-standard stretch head for use with stretch forming presses. The casing of the head, made in various sizes, may be fitted with jaws giving either two, three or four angular sliding movements. The heads can be adapted to pulling either extruded shapes, brake or rolled sections, or flat sheet stock, and have been used successfully on all grades of aluminum alloys and stainless steel. The smaller size jaws may be hand released, the larger sizes utilize air or hydraulic cylinders to clamp and release the work. The jaws are so constructed that different inserts can be readily adapted to accommodate different shapes. The jaws are loaded by simply pushing the material in; and unloaded by pulling the release handle forward and removing the stock. A52-M

A check list on plastics from nitrocellulose is available from the Cellulose Products Department, Hercules Powder Co., Inc., Wilmington 99, Del. Physical properties and application advantages are presented graphically.

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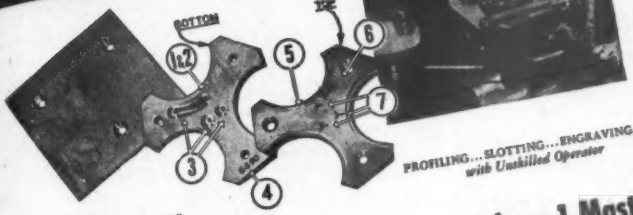

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7 OPERATIONS—(1) ROUGH MILL three arc sections...(2) FINISH-MILL sections...(3) MILL semi-circular groove and two ⅝2" counterbores...(4) ENGRAVE Part Number ...(5) Reverse Master and Part, PROFILE three U-shaped grooves along arc edges...(6) ENGRAVE word "SPREAD" and (7) ENGRAVE three Y-SLOTS to penetrate counterbores.

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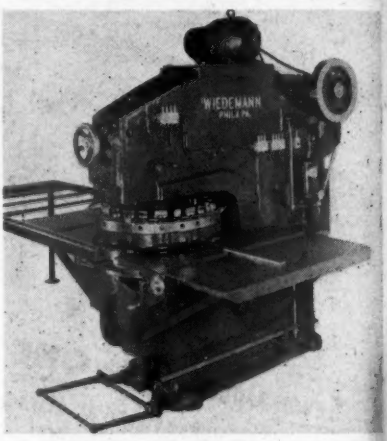
Short Run Piercing Economy

"The Story of Short Run Piercing Economy" published as Bulletin No. 92 and detailing short run piercing job factors as well as layout and set-up of the Wiedemann Turret Punch Press is available from the manufacturer, Wiedemann Machine Co., 1815-31 Sedgley Ave., Dept. TD, Philadelphia 32, Pa.

Piercing job factors are discussed relative to the use of the Wiedemann Tur-



ret Punch Presses. These presses eliminate die set-up changes from one die to another, being made by the operator in 5 to 10 seconds as compared to 15 or 20 minutes on conventional equipment. The number of die set-up and layout men required is reduced. Proper material handling is essential in rapid piercing.

The turrets can be supplied in varying number of stations from 11 to 32 positions. For most applications both upper and lower turrets are in a horizontal position. This arrangement is well adapted to piercing, notching and knockout operations in flat work. A vertical lower turret is also available in one type. This is especially adapted for such operations as piercing and dimpling for fasteners and for piercing curved parts as typical in the aviation industry. The turret rotations are synchronized; turrets may be hand or power rotated for speeding station selection;

(TO PAGE 190—PLEASE)

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(CONTINUED FROM PAGE 188)

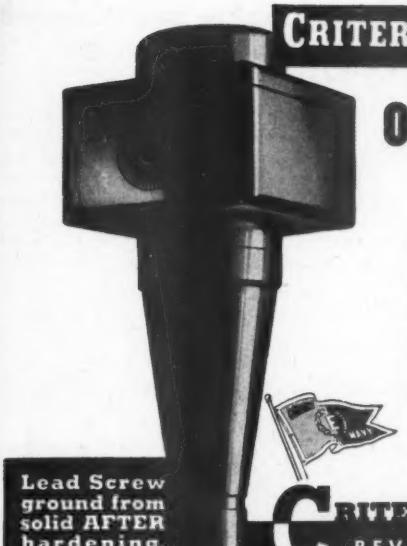
and die holders are interchangeable when required for rapid changing of irregular and compound dies.

Wiedemann gauging arrangements are fast and simple and are made to function as universally as possible. Some gauges are adaptable for work as high as 800 to 1200 pieces; other types are best suited for extremely large work which would normally require two or three men in the handling of the material alone. Gauge tables offer the fastest method of material handling, as well as positioning, on short runs without the use of layout. Turret punch presses range from hand operated bench types to power presses of 80 tons capacity, having 60" throat depth. 818-M

Hardness Certifier Speeds Accuracy Marking

The Martin Hardness Certifier, a mechanical device for testing and automatically certifying the hardness of aluminum alloy parts, has saved more than 1050 man-hours during the last 11 months at The Glenn L. Martin Co., Dept. TD, Baltimore, Md. An average saving of 1¼ seconds per part was made on the estimated three million parts that have passed through the original machine. The unit was designed and built by Adolph Vlcek Jr., Inspector, Army Division.

The Hardness Certifier consists of a flat-topped base which serves as a work table, an upright support rigidly secured to the base and an arm supported by the upright which affords a mount for the stamp mechanism—essentially a plunger and an operating solenoid. The inspector's personal stamp and the hardness stamp are removably secured in the plunger. The testing and stamping operations are combined, the procedure being mechanical and automatic. The machine is set for the material thickness and the minimum satisfactory hardness—80 for ST aluminum. Parts are fed under the indentor point of the hardness tester at the rate of 43 pieces per minute, the rate found most satisfactory. If the part measures up to the specified hardness, the plunger automatically marks it with both stamps. If too soft, the plunger remains inoperative. A23-M



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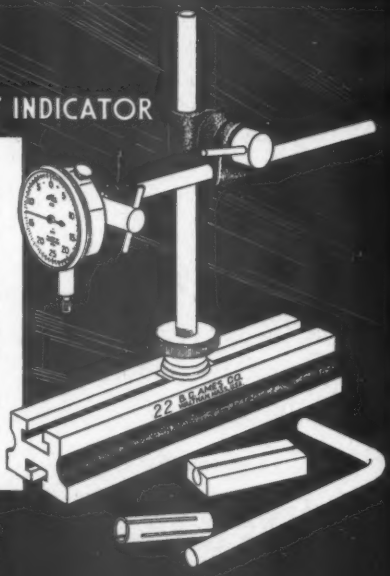

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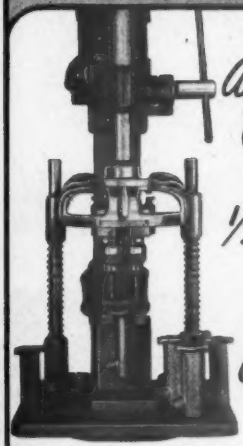

✓ *Adjustable Centers from 1/2" to 6"*

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Sleeve and overarm types ... in several sizes. Will double output of any single spindle drill press.

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Chip Breaker and Diamond Finishing Grinder

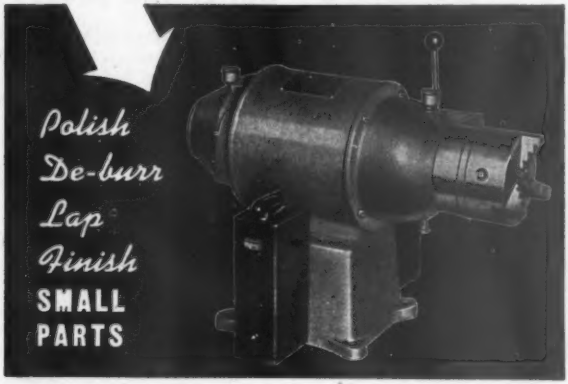
A new heavy duty Chip Breaker and Diamond Finishing Grinder is announced by Hammond Machinery Builders, Inc., Dept. TJ, 1631 Douglas Ave., Kalamazoo 54, Mich. The new grinder, Model CB-76, built to meet requirements of large tool rooms and production plants where a large volume of carbide tools are being ground, is designed for

accurate grinding of chip breaker grooves and for precision finishing of all single point carbide tipped tools.

A feature is a newly designed any angle vise that will handle all types of box and single point tools up to 2" (larger if required). The any angle vise has universal adjustments; the direct reading dials eliminate guesswork from calibration of correct grinding angles, according to the manufacturer.

The diamond finishing grinding side is designed for either a 6" or a 7" diamond cup wheel. A screw adjustment moves the tilting table assembly in and out, avoiding possible damage to the cup wheel. Table-well clearance permits wheel changes without removal of table assembly.

Complete information will be furnished by the manufacturer. 95-M



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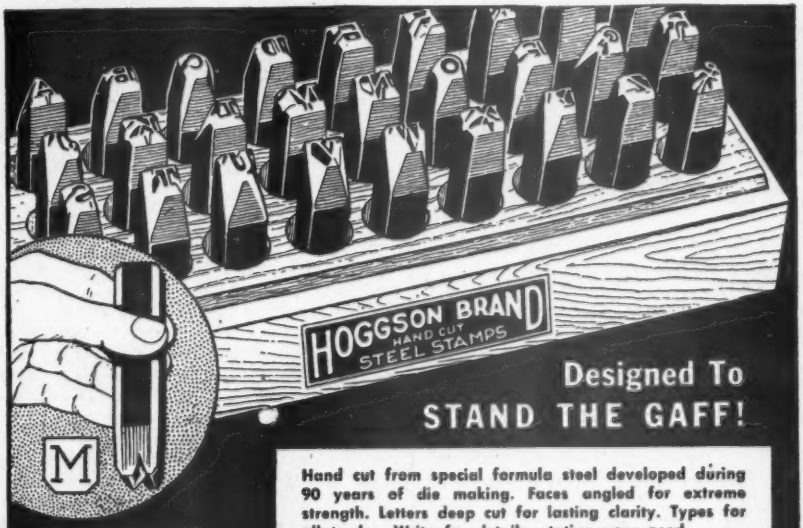

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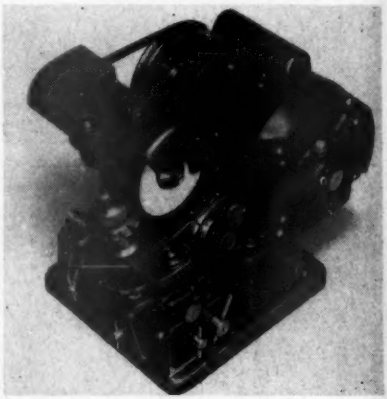
Cutter Sharpener

The new Waltham Cutter Sharpener, designed for fast accurate sharpening of cutters used for gear cutting and thread milling, circular form tools, straight fluted hobs and multiple cutters is a product of Waltham Machine Works, Waltham, Mass. Edward Blake Company, Dept. TD., 634 Commonwealth Avenue, Newton Center 59, Mass., is exclusive sales agent.

The Sharpener consists fundamentally of a stationary wheel head unit and a work head unit mounted on a rocker bar. This allows the work head to be swung to and from the wheel during the sharpening operation. The precision ground wheel spindle is mounted in spring-



loaded ball bearings and is driven through a V-belt at the back of the bed.

The diamond holder is set at an angle to the wheel so that when the diamond shows signs of wear, it can be turned to present a new, sharp edge to the wheel.

The work head holds a hardened and ground spindle. The cutter is mounted on the upper end of the spindle; an index plate is mounted on the lower end. The index plate has the same number of accurately spaced, tapered slots on its circumference as there are teeth on the cutter. The whole spindle assembly is rotated by hand during the grinding operation. The cutter is positioned through a thumb operated pawl which engages in the index plate slots.

A four-page circular is available. 514-M

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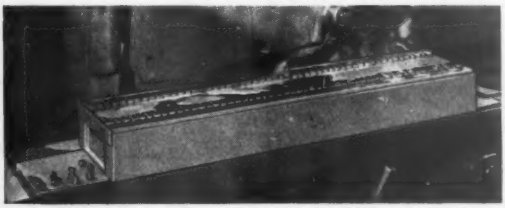

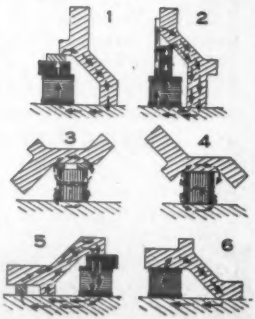

These illustrations show a few of the many grinding operations made possible by using "POWER GRIP" Magnetic Chucks.

Line drawings at right indicate path taken by Magnetic Flux through Chuck, Parallel, work to be held, and extra Iron Blocks to handle difficult setups.

The units operate on 110 volts A. C. transformed and rectified to 6 volts D. C. Send for complete catalog.

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No longer is it necessary for you to cut down one of your drills for centering purposes. These tools are designed to give long and dependable performance.

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Satisfaction assured on a complete stock of all types of standard cutting tools and end mills.

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Plastics Rivets Developed by Douglas Aircraft

Development of a plastics rivet, primarily for the attachment of airfoil surfaces, has been announced by engineers at the El Secundo, California, plant of the Douglas Aircraft Company.

They foresee many other uses for

plastics rivets in the aircraft and other industries.

Most interesting feature of the new rivet is the method of installation, by compressed air, at 30 lbs. pressure. The rivet is first center-bored and pre-heated.

The center-bore extends to within a short distance of the bottom of the rivet,

(TO PAGE 198—PLEASE)

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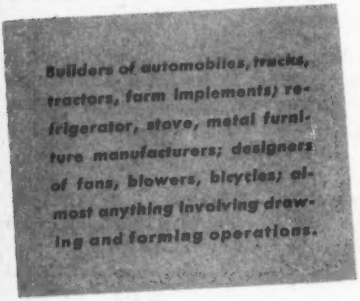
TIME YOU DISCOVER STRENES METAL

● This is no idle suggestion for engineers in many lines have tried and adopted Strenes Metal — are regularly specifying it wherever possible.


Builders of automobiles, trucks, tractors, farm implements; refrigerator, stove, metal furniture manufacturers; designers of fans, blowers, bicycles; almost anything involving drawing and forming operations.

They are able to have Strenes Metal cast to shape — usually to 1/16", saving 50% to 75% of the time ordinarily required to machine off excessive stock. They are obliged to redress their dies about ⅓ as frequently as usual. Runs of 1,000,000 deep drawn parts are not unusual.

That is just part of the Strenes story. Why not get the rest of it? Isn't it high time you also "discover" Strenes Metal for drawing and forming dies?

THE ADVANCE FOUNDRY CO.,

Dayton 3, Ohio

Strenes METAL

(CONTINUED FROM PAGE 196)

forming a pocket for the compressed air. Just before driving, the rivet is heated and the compressed air is then applied through the center-bored head. This causes the shank end to expand or "balloon". This expanded section hardens immediately—clinching the rivet firmly in place.

Three main properties were necessary in a plastics material for the rivet; it must have satisfactory impact and tensile strength; must soften at temperatures low enough to permit handling without special equipment; should have a coefficient of expansion low enough to prevent loosening of the rivet upon cooling.

The plastics material should also be resistant to oil, gasoline, solvents and other chemicals common in aircraft operation—besides possessing a softening point higher than the temperature range met in service conditions.

It was found that acrylic rivets developed very satisfactory tensile strength, were easy to install and gave uniform results. The acrylics are noted for their "plastics memory"—the ability to regain its original shape upon subsequent heating—an important factor where disassembly or removal of rivet is required.

Application of heat causes the expanded end of the rivet to shrink to original size, and the rivet may then be easily removed, when for any reason this is necessary.

A surprising property of plastics rivets was the strength exhibited after installation. In mock-up installations, tough airplane fabric was riveted to a trussed aluminum rib using center-bored ¼ inch acrylic rivets. When air pressure was applied to the interior of the mock-up, failure was in the fabric. Calculations showed that a load of 49.3 lbs. had accumulated on each rivet before the fabric failed. Subsequent tests with the rivet installed in a tensile jig gave an average breaking strain of 220 lbs.

A recently developed process for electro-plating plastics lends even more promise to plastics rivet development and use. In tests, electro-plated plastics rivets developed greater tensile strength,

(TO PAGE 200—PLEASE)

TIME SAVER

FOR QUICK CHANGE MARKING

- Fastest and simplest way to number parts.
- Easy! Just turn screw to change numbers.
- Made of best quality tool steel.
- Guaranteed for years of service.
- **PROMPT DELIVERIES**

STOCK TYPE

1... BA 1864249
2... BA186429
3... BA 1864

SOSSNER

161 Grand St. New York 13, N. Y.

WITH HANDY TYPE BOX

NEW... SUPERIOR... EXCLUSIVE...

New safety cup disc, now standard equipment, is the greatest safety unit ever installed on any carbide tool grinder. It is an integral part of cup wheel hood design, adjustable for wheel wear. Before you buy a carbide tool grinder . . . investigate . . . compare! Hammond's complete line, from chip breakers to 20" grinders, gives you complete facilities for carbide tool maintenance.

Hammond SAFETY FEATURE!

AN INNOVATION . . . PROVIDES COMPLETE PROTECTION WHILE GRINDING

Prevents operator getting fingers, or dropping tools, into cup of wheel.

Hammond Machinery Builders INC.

KALAMAZOO 14 MICHIGAN

1631 DOUGLAS AVENUE

Eastern Branch—71 W. 23rd St., New York 10, N. Y.

(CONTINUED FROM PAGE 198)
flexural strength and dimensional stability than the unplated variety.

The plated rivets can be driven just as successfully as the unplated type. Crazing of the plated deposit occurs on the expanded end, but all visible portions of the rivet are entirely unaffected by the driving process. A61-M

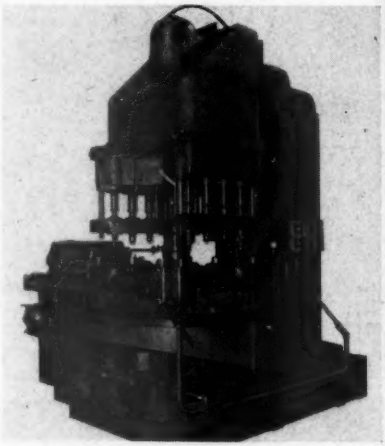
Universal Drill Bushings save valuable tool drills. Because they are straight and round and have

super-finished bores, Universal Drill Bushings insure accuracy and possess unexcelled wearing qualities. Tough, precision-made. Write today for further facts about Universal Drill Bushings, Collet Chucks, Floating Chucks and MIKRO-LOK Boring Bars.

UNIVERSAL ENGINEERING
FRANKENMUTH,
MICHIGAN

Vertical Hydraulic Feed

A new Baker Extra Heavy duty 60-HO vertical hydraulic feed machine with auxiliary horizontal hydraulic feed unit, especially developed for drilling, boring and counterboring operations in track links is announced by Baker Brothers, Inc., Dept. TD, Station F, Toledo 10, Ohio. The track links are used on tracks of heavy duty tractors for Army duty. The vertical hydraulic feed machine performs the various operations in the two



large bores in the links. It is furnished with a heavy duty 12 spindle head mounted on an ample sized saddle. Because of the large head with its overhang, a center mounted cylinder with ample feed pressure for the operations is mounted fixed on the center of the index table, equi-distant from all spindles. The index table carrying work holding fixtures rotates around this cylinder. This is a new, unique feature particularly adapted on heavy duty large size head machines. At each cycle two track links are produced, one right hand and one left hand. The four station power index table allows loading and unloading of two parts at chucking position while the machine is cutting.

The horizontal hydraulic feed unit with multiple head drills the two bolt holes in the sides of the links. A63-M

IDENTIFICATION INKS in 12 distinctive colors

Easy to apply. DRY INSTANTLY

For practically any non-absorbent surface

Time Savers in the Stock Room

Dayton Rogers Identification Inks speed up stock room service, prevent errors and provide visual inventory according to your own code. Identification Inks are used for marking sheets, strips, bar stock, tools, dies—also temporary marking of machined parts in production processes. Just wipe surface clean and apply with brush or pen. DRIES INSTANTLY with hard surface. Can be wiped off with Dayton Rogers "Remover".

PRICES—4 oz. bottle with brush cap, 60c. Pint $1.00. Quart $1.75. Gallon $5.00. Specify colors desired. Circular 187-15 on request.

DAYTON ROGERS MANUFACTURING CO.
2844 12th Ave. S., Minneapolis 7, Minn.

USE

Fluid-motion

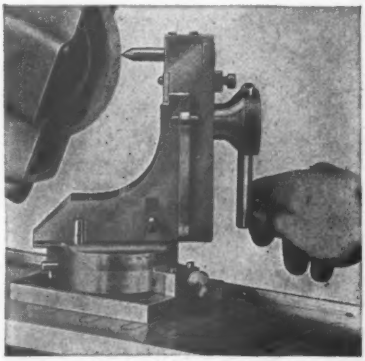
for modern form-dressing

ONE SETTING HANDLE CONTINUOUS MOTION

The J & S Model "E" Radii and Angle Dresser in the new "Fluid-motion" series is one of the finest precision dressing instruments procurable—regardless of cost.

FEATURES

Fluid-motion dressing
.0001" accuracy
Automatic centering
14" wheel capacity
Large range yet compact
Chatterless and dustproof



J. & S. TOOL CO.
477 MAIN ST. E. ORANGE 4, N. J.

Get maximum production from lathes, screw machines, punch presses, shapers and other equipment now belt driven from shafts, by modernizing with CULLMAN Motor Drives.

You can increase machine output 25% through greater flexibility, instant control, and belt drive smoothness. You can install CULLMAN Motor Drive in a few hours. On most machines only four bolts are necessary. CULLMAN Motor Drives are made for motors ranging from ¼ to 15 H.P.

Don't delay. Start taking that extra production now. Prompt deliveries can be made.

CULLMAN
WHEEL COMPANY
1332 Altgeld St., Chicago 14, Ill.

New "Flat Top" Work Holder

A simplified new type of fixture for holding small flat work for toolroom use and certain other types of production operations is announced by the Mead Specialties Co., Dept. TD, 15 So. Market St., Chicago 6, Ill. The new Mead "Flat Top" Work Holder was developed to overcome difficulties encountered in drilling, countersinking and tapping small

precision parts in which "dead true" perpendicularity was essential.

The fixture holds any type of work which is flat on the bottom, from a few thousands up to a couple of inches in thickness, regardless of peripheral contour. In addition to drilling and tapping it is ideal for many operations on small shapers and bench milling machines. One of the supporting plates is perforated and provided with three studs. This end is used for milling and shaper work. Two studs are set in position to locate the back of the work and a third is set at the end to support the work against the pressure of the cutting tool. Flat pieces too delicate to be held by edges are safely held.

The "Flat Top" is actually a universal jig which can be changed from one set-up to another by dropping three studs into three holes. Adjustment for work thickness is made by turning the knurled head of the ball-joint stud. 569-M

DRY Model

Machine illustrated is suitable for intermittent cutting.

WET Model

Machine with coolant permits high speed, straight line production cutting. Attachment does not interfere with convenience or portability, and operates clean and dependably.

Does it make sense to cut off rods—bars—or angles on large high priced—slow speed equipment when MOST OF THOSE SAME JOBS can be cut more conveniently and economically on this portable low cost machine?
Speed and precision—both—result from the smooth, continuous cutting action. A machine that is FAST BECOMING standard in modern plants.
Two Sizes—8″ x 16″ and 8″ x 24″. Four speeds for any metal. Plugs into light circuit.

★ *Write for Bulletin or Ask your Dealer!*

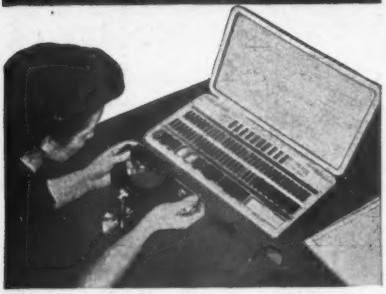
MACHINE TOOL DIVISION KALAMAZOO TANK & SILO CO
KALAMAZOO, MICHIGAN

New Universal GREENFIELD Grinder Speeds Tool and Cutter Grinding

The variety of easily set up attachments available for the GREENFIELD No. 4 Tool and Cutter Grinder makes it an invaluable production and toolroom machine. The generous bearing areas incorporated in the head and spindle design of the new and improved GREENFIELD Wheel Head insure long dependable life in "round-the-clock" production. Its versatility meets the demands of toolroom work for grinding formed cutters, taper and rose reamers, also straight surface work as well as the grinding of compound angles. Send for detailed and illustrated job application bulletin.

PRODUCTION
MACHINE CO.
GREENFIELD, MASS.

Take the "GUESS" Out of Inspection



Check Your Gages Daily

Be sure that every shipment of parts will be accepted. Avoid delays and extra man hours required to replace orders of important products because of dimensional inaccuracies.

DoALL GAGE BLOCKS

The modern key to exactness and precision in experimental laboratory, tool room and on production lines. To take care of every gage block need, DoALLS are furnished in three different accuracies:

Laboratory Set	—	2 millionths of an inch
Inspection Set	—	4 millionths of an inch
Working Set	—	8 millionths of an inch

FREE—Handbook of Scientific Inspection. Tells about the many uses and advantages of DoALL Gage Blocks. Just write for a copy of "QUALITY CONTROL."

CONTINENTAL MACHINES, INC.

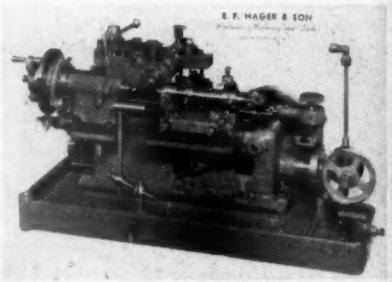
Manufacturers of DoALL Contour Machines and Surface Grinders. Offices in Principal Cities.

1303 S. Washington Ave., Minneapolis, Minn.

Automatic Pinion Cutting Machine

An Automatic Pinion Cutter, adapted and designed for the most delicate milling of gears and pinions where extreme accuracy is the first consideration, is manufactured by E. F. Hager & Son, Dept. TD., Queens Village 9, L. I., N. Y. Entirely automatic in operation, the machine will perform rough and finish cuts in one cycle. Tolerances of ± .0001 have been held on circular pitch and of .00005 pinion eccentricity.

The Pinion Cutter is in use in many aviation parts and similar war plants

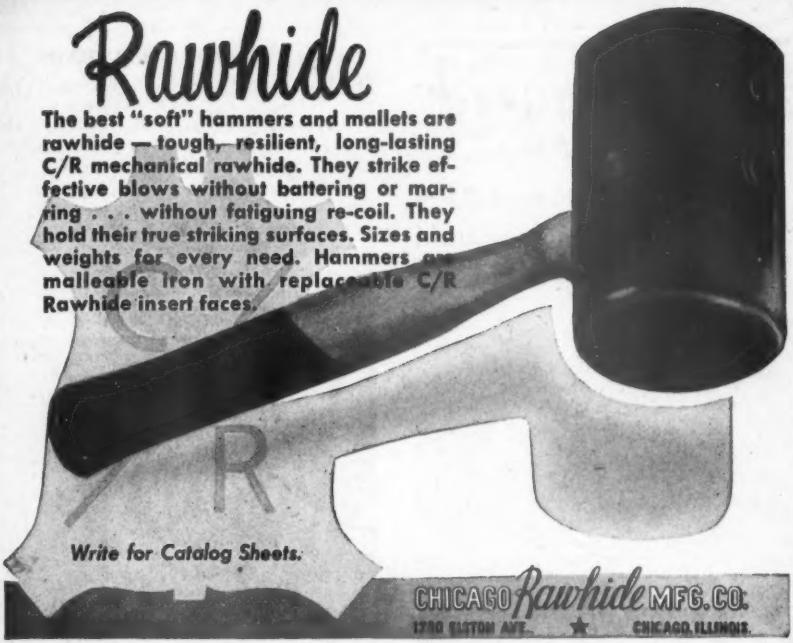


where close specifications and quantity production are requisites. The machine is sturdy and an experienced operator can master the operation and maintenance routine in a short time. When the unit is started at the beginning of a cycle, it proceeds automatically to rough cut all the teeth on the pinion blank, shifts the cutter spindle over and finish cuts the teeth with a second cutter; then after finish cutting the last tooth stops in an idling position to await insertion of the next blank. Correctly set-up and adjusted, the Hager Pinion Cutter cuts scrap to a minimum because of its automatic operation and its ability to hold close tolerances through a long series of repetitive operations.

The unit will cut from 6 to 100 teeth on pinion blanks of ½" maximum diameter and length or gear blanks of ⅝" maximum diameter. Compact in size 14" x 37" (floor space 20" x 40") batteries of five to ten machines can be handled by one operator. A microscope attachment can be furnished for extremely small precision work. A64-M

Rawhide

The best "soft" hammers and mallets are rawhide — tough, resilient, long-lasting C/R mechanical rawhide. They strike effective blows without battering or marring . . . without fatiguing re-coil. They hold their true striking surfaces. Sizes and weights for every need. Hammers are malleable iron with replaceable C/R Rawhide insert faces.



Write for Catalog Sheets.

CHICAGO *Rawhide* MFG. CO.
1700 ELSTON AVE. ★ CHICAGO, ILLINOIS.

MODEL 3 CONTOUR GRINDER

For economical, rapid and accurate grinding and polishing of contours or irregular shapes.
Capacity, diameter of wheels—½" to 4". Capacity, face of wheels—2", 2½", 3". Diameter of table—18".
Vertical reciprocation movement of spindle—⅜".
Quickly - mounted diamond dresser is standard equipment.

Write for folder of complete details.

No. 43 LEVELING JACK

Maintaining of machines level on foundations is important to accuracy.

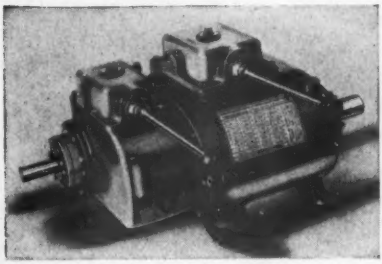
Write for circular.

BAKER *Brothers, Inc.*
Drilling, Boring, and Tapping Machines TOLEDO, OHIO

Western "SUPER"

up to 30 H. P. with

8 SPEED CHANGES in geometric progression of 1.20 (total red. 6:1)



For use on large lathes, boring mills, Ingersoll mills, rubber and chemical machinery, etc., and for replacement of gear boxes and large radial drills, Bullard vertical turret lathes, etc. $495

. . . Western MAJOR (10 h. p. capacity) 4 speed (forward & reverse) transmission with bracket $145

. . . Western MASTER (5 h. p. capacity) 4 speed (forward & reverse) transmission with bracket . . . $ 95

We can supply necessary V-belts, sheaves, output pulleys and motors from stock. Prompt deliveries on high priority.

WESTERN MANUFACTURING CO.

3400 Scotten Ave., Detroit 10, Mich.

High Speed Pictures Help Production Research

By using an Ultra High Speed Motion Picture Camera where film flows at 62 miles an hour past the lens, a picture-taking rate of over 3200 frames a second is achieved, a speed adequate to study motion in 85 per cent of today's industrial operations—even those with rapid movements which cannot be seen or analyzed by the human eye.

Since the knowledge of what occurs during a given movement in the manufacture of many industrial products is often a prerequisite for better design or more efficient production methods, the need for a facility capable of revealing important phases of rapid motion is readily apparent, especially one which does not exert any mechanical influence on the subject or is in any way limited to the observation of periodic and constant motion.

The Ultra High Speed Camera has proved itself an invaluable tool for this purpose. McLarty Business Films of Buffalo, New York, have pioneered in the High Speed film by providing a complete research service employing this new medium which is available for in-

(TO PAGE 208—PLEASE)

BACK OF THE BREN GUN - Brightboy

Top: Polishing and removing burrs on Bren Gun port piston.

Bottom: Close-up of finishing, gun extension posts.

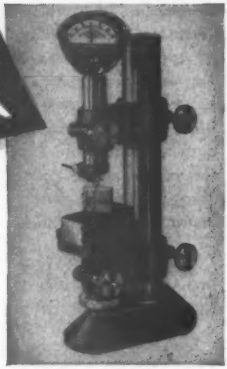
On many of the important parts of the precision-made Bren Gun, Brightboy's resilient rubber and abrasive has materially speeded production and improved quality. Brightboy is back of the Bren Gun and hundreds of other implements of war with a new conception of precision-quality finishing and will continue to bridge the gap between the grind and the buff in peacetime production applications. Brightboy is made in a wide variety of shapes and sizes for manual and machine work. Our Service Department or field representatives will show you how to save time — improve quality — in your abrasive finishing. Ask your dealer for prices and Applications Data.

BRIGHTBOY INDUSTRIAL DIVISION
WELDON ROBERTS RUBBER CO.
Newark 7, N. J.

WELDON ROBERTS
Brightboy

MIKROKATOR
"MIKRO" (MINUTE)
FRICTIONLESS AMPLIFICATION

Positive, Dependable Repeat Readings



NO friction, lag or backlash . . . no racks, pinions, gears, levers, etc. subject to wear. Pointer responds instantly without swinging past true reading. Amplification is 100% mechanical, no lights or electromagnets, no warming up period required. Easily moved to different locations as there are no electrical connections. Our engineering department is at your service for applying Mikrokator to your measuring problem.

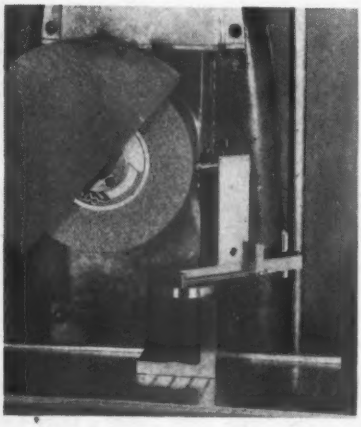
Graduated — .0001" to .00001".

Graduated — .001 mm to .0002 mm.

WRITE FOR LITERATURE

SWEDISH GAGE CO., OF AMERICA
8900 ALPINE AVE., DETROIT 4, MICH.

The FORM-MASTER
ANGLE AND RADIUS DRESSER



An all-purpose angle and radius dresser for high-precision at low cost. Accurate easily within .001". Simple to operate. Dresses in vertical position enabling operator to SEE the form in work. All parts hardened and ground (except cast-iron base which can be drilled and tapped). Suitable for surface and cylindrical grinders. Two 1/3 ct. quality diamonds and instrument case included . . . $150.00.

It readily produces: Any desired angle; Convex radii to 4"; Concave radii to 7". On 7" wheel.

Specifications: Base 3"x 3", Height 8½"; Wheel capacity 10"; Angular travel 3".

For information or a demonstration
CALL YOUR SUPPLIER.

MANUFACTURED BY
J. & S. TOOL CO.
477 Main Street, East Orange 4, N. J.
• PRECISION DRESSING TOOLS •

(CONTINUED FROM PAGE 206)

dividual application on demand. H. H. McLarty, Director, Research Division, has presented an outline of the history and development of high speed photography—its present status as a science and its value in the analysis and study of high speed motion before the Cleveland District Section, Association of Iron and Steel Engineers and similar groups throughout the East.

In a paper titled, "Harnessing Time and Motion for Industrial Research," Mr. McLarty says: "With this new instrument of research and operational trouble-shooting, mile-a-minute speeds show on the screen in slow-motion at 26 feet a minute; 3000 rpm's become 15, with all the motion effects of the higher speeds retained. Motion is reduced to 1/200th of actual. One hundred feet of standard 16 mm film pass through the camera in 1¼ seconds, yet take 4½ minutes to view on the screen.

"Long limited to the 64 and 128 frames a second of older types, which failed to record the higher speeds of modern tools, designers and research engineers are learning unbelievable lessons as revealed by the 3200 frames a second of this new camera. Theoretical assumptions are being verified or discredited with uncompromising factual data. Motion is undergoing intelligent analysis and scrutiny, much as was made possible in other lines of research when X-Ray, high power microscopes and other scientific research instruments became available."

In the application of the Ultra Speed Camera to scientific research, the correct method of interpreting the film is of the utmost importance. High speed pictures can be studied under standard projection speed as a slow motion picture in any standard 16mm projector. Where original photography has been executed at 3200 frames per second, these pictures may be viewed at a speed 200 times slower than normal, when projected at 16 frames per second. Slower taking speeds reduce the proportion, but even at the slowest speed possible with this equipment—900 frames per second—extreme slow motion is evident on projection and is most helpful in analytical work. These same pictures may be studied frame by frame

(TO PAGE 210—PLEASE)

Looking at .00002 OF AN INCH . . . !

Soon new precision gages for peacetime production will be needed. Haines offers you a dependable source of supply with the "know-how," experience and facilities to produce working and inspection gages to your specifications. You can stake your reputation on Haines Gages. Send us your inquiries. Request illustrated circular. HAINES GAUGE CO., 2301 W. Allegheny Ave., Philadelphia 32, Pa.

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PRECISION GAGES

PLUG • RING • SNAP • FLUSH PIN • PROFILE • ETC.

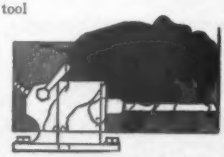
Presenting the Famous

MEAD AIR CLAMP

For Greater Drill Press Output

Prompt Shipment!

WHEREVER a drill comes down, *something* must hold the work. Wherever a drilling-jig is required, *Air-Clamp* will simplify it. Wherever *speed* is desired, *Air-Clamp* will produce it. *Air-Clamp* holds with relentless pressure; it is undisturbed by size variations (such as in castings), it scoffs at vibration (how many drills have been broken due to faulty hold-downs?), chatter, snagging. *Air-Clamp* holds work of any size or shape in any position, at any angle. Can pay for itself on a single fixture; saves its costs on a few days' drill-press output. Reduces operator fatigue. Saves hours and dollars in drafting-room, jig department, tool room and production line. *Air-Clamp* fits any drill-press having a cylindrical column. Special fixtures for Tee-slotted tables, light milling work, etc. Hand and/or foot control. Shipped on approval to responsible concerns. Write for new Air Power Catalog.



MEAD SPECIALTIES COMPANY

15 SO. MARKET STREET DEPT. 74-HA CHICAGO 6, U.S.A.

Reg. U.S. HY-PRO Pat. Off.

TAPS

These high production taps produce consistently more accurately threaded pieces to lower the cost of your tapping operations.

Precision ground from the hardened solid of high speed steel, HY-PRO tap tolerances are held to extremely close limits. *Accurate tapping assures tighter, stronger fastenings that defy vibration!* Specify HY-PRO for High Production.

Commercial and Precision Ground Thread Taps

•

Special Ground Thread Taps

Write for Catalog on Company Letterhead

HY-PRO TOOL CO.
New Bedford. Mass. U.S.A.
489 Mt. Pleasant St. BUY BONDS

(CONTINUED FROM PAGE 208)

with a suitable magnifying glass or low power microscope.

One of the most comprehensive series of studies made with the high speed medium was in the field of construction and design of machine tools. The high speed camera has aided greatly in determining a number of important factors of tool production, because it has:

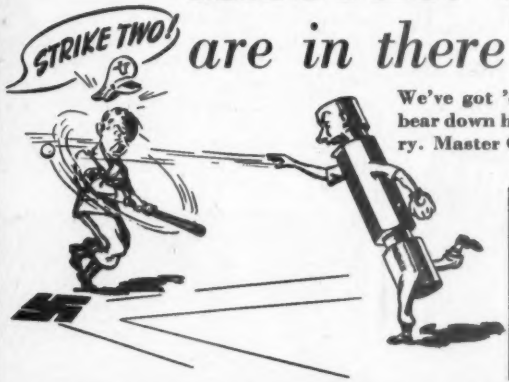
1. Determined maximum working speeds to which a machine tool can work without erratic operation.
2. Indicated the exact point of danger in material distortion.
3. Shown the angle of distortion of metal on the head of a tool.
4. Indicated the depression and consequent deflection of cutting tools as they build up power to make a cut.
5. Shown the direct relationship between the speed of a tool and its tendency to compress and deflect.
6. Contributed much to the study of distortion due to excessive heat in high speed operation.
7. Provided a chart from which a determination could be made of the maximum speeds possible with minimum regrinding of the tools in use.
8. Definitely indicated the cause of chatter through the study of arbor "wind-up", heat, deflection, irregular feeding, etc.
9. Ascertained the most effective rake and clearance angle necessary to produce a maximum cut at maximum speed.
10. Determined a means of control of the abrasive action or cratering of tools at their face.

All in all, the high speed camera has saved the tool engineer considerable time in research and study and has helped materially in creating tools of greater efficiency and greater potential speed so vital to our all-out industry today.

In addition to the field of pure research, there are two other important uses for ultra speed photography:

1. Incorporating ultra speed with normal speed photography in visual-training films to more readily explain the operation of high speed tools and the intricacies of peculiar fabrication techniques.
2. In sales promotion and institutional films, where the selling points of fast-operating features may be brought down to comprehensible speeds.

MASTER GAUGES are in there Pitchin'--



We've got 'em swingin' . . . so let's all bear down hard and get it over in a hurry. Master Gauges are doing their part.

THREAD PLUGS
THREAD RINGS
PLAIN PLUGS — PLAIN RINGS
SNAP — PROFILE
CONCENTRICITY AND BUILD-UP GAUGES
JIGS AND FIXTURES

MASTER GAUGE CO.

Phone: University 3-7676
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Delivering to War Industry

Improved Steel

for Better, More Durable Weapons of War

THE LAKESIDE STEEL IMPROVEMENT CO
5418 Lakeside Avenue CLEVELAND, OHIO Phone HEnderson 9100

The WIGGLER has had its day!

Now CENTER-SCOPE Gets the Play!

There was a time when the wiggler was considered "tops" for positioning a machine tool spindle. BUT, THAT'S NOT TRUE ANY MORE.

The Center Scope is now the fastest method for accurate centering of a machine tool spindle. It has a trimming screw to compensate for spindle run-out, which European-made microscopes do not have. 45X magnification makes it easy to work to tenths.

As a top-flight mechanic, you should own a Center Scope — or, if you feel that the boss should buy one, *put the bee on him.*

Center Scope with Illuminator and Eye Shield.....$97.00
f.o.b. Milwaukee

Edge Block for use with Center Scope $23.00

For complete details, write Dept. CS (3)

Kearney & Trecker Products Corporation
MILWAUKEE 14 WISCONSIN

Universal Capstrip Die

A universal capstrip die for forming accurate contours in capstrips, designed and built by Waldron R. Bruce of the Airplane Division, Columbus, Ohio, plant of Curtiss-Wright Corporation, has overcome difficulties encountered in several forming methods previously used.

The forming of contours in capstrips has been difficult because of the wire retainer slot in the capstrip. Unless the

slot is perfectly formed the work material will tear. Any damage to the slot scrapped the capstrip. A form block was tried and the contour formed with a rawhide mallet. This was unsuccessful due to the formation of wrinkles in

(TO PAGE 216—PLEASE)

ILLINOIS DIE FILING MACHINE

Reduce costs and improve quality with this TRIPLE-PURPOSE Machine

A versatile bench type machine for all three major production steps in the die-making process—sawing, filing and stoning. Quality built throughout to stand up longer and produce more accurate work. Forced-feed lubrication plus hardened and ground shafts running in bronze bushings combine to minimize wear and prolong life. Maintained accuracy is secured through holding chuck and clamping device which provide positive file alignment, and balanced moving parts which operate without vibration. ***Write for descriptive literature.***

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Knurled SOCKET HEAD CAP SCREWS

Save Money By Saving Time

The **knurled head** gives the mechanics' fingers a better grip. There's no slipping. Every twirl of his fingers counts. So by avoiding lost motion, the **knurled head** cuts down the time to drive each screw home.

Saved time is saved money. The more cap screws required in each assembly, the more time saved by using "UNBRAKO" KNURLED SOCKET HEAD CAP SCREWS.

Pliers won't slip on the knurled heads of "UNBRAKO" Caps which greatly facilitates making minor adjustments in places hard to get at with a wrench.

Knurled "UNBRAKO" Caps can be locked in place to prevent rattling loose.

The excellent performance given by "UNBRAKO" Socket Cap Screws is due to their great strength, hardness, and precision manufacture. Sizes from No. 4 to 1½" diameter—Full range of lengths.

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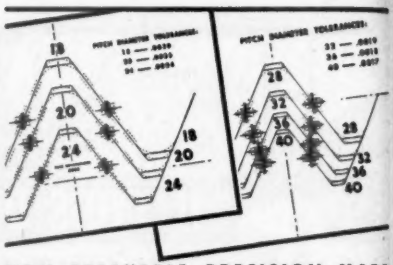

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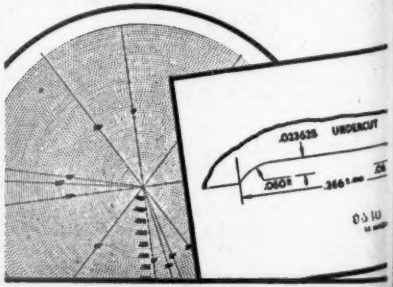

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Use Top Table as Shown
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Tilt top table back. Use lower table

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Features Include:

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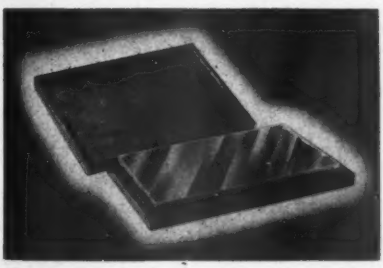

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affords you the PLUS advantages of Highly Polished Surface and Transparency

Moreover, its crystal clear glass texture promptly reveals mis-use, and because it is "glass", it receives better care and handling.

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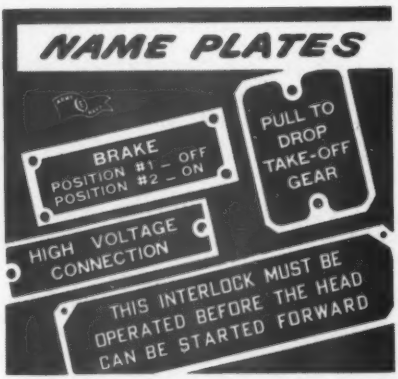
NAME PLATES
BRAKE
POSITION #1 — OFF
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PULL TO DROP TAKE-OFF GEAR
HIGH VOLTAGE CONNECTION
THIS INTERLOCK MUST BE OPERATED BEFORE THE HEAD CAN BE STARTED FORWARD

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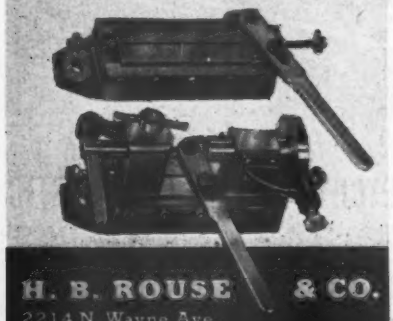
Rouse Fixture Set-Ups may help you solve the problem of your overworked tool makers.

Rouse Fixture Set-Ups are simplified basic fixtures made for the most frequently used movements in smaller machining and finishing operations.

They are readily adaptable, being equipped with key ways that permit their use on many machines. They eliminate much experimentation and preliminary work on primary movements. Often only a final work holder is necessary to adapt them for immediate production.

Before you do further preliminary work on fixtures, you should have full information and illustrations of Rouse Fixture Set-Ups.



H. B. ROUSE & CO.
2214 N. Wayne Ave.
Chicago 14, Illinois

(CONTINUED FROM PAGE 212)

the shank of the capstrip. A contour block, with the capstrip formed with an air hammer mutilated the slot. A steel die designed for punch press operation was given several trials but had to be scrapped because the punch damaged the wire retaining slot.

Mr. Bruce designed and built the universal capstrip die, as illustrated, using scrap steel. The die is really two die presses, the right being used to form the original contour in the capstrip; the left press with reverse die contours being used for correcting overcontoured capstrips. The presses are actuated by identical rotary cams manually operated by suitable handles.

To operate, a shim of the same thickness as the shank of the capstrip is selected and inserted under the lower or stationary dies in each press and between the dies and the tables. The stationary die is tightened against the shim to prevent the formation of wrinkles in the capstrip shank. The capstrip is then placed flat on the die table, the shank extending under the stationary die to the shim and both sides of the slot bearing against the upper or movable die. The contour is formed by a succession of light pressures exerted through the cam handle. The degree of contour is checked against a template and, if necessary, corrected on the left or reverse contour press. A66-M

New Synthetic Rubber Plasticizer

A new resin plasticizer, known as Paraplex G-25, that possesses high resistance to oils, gasoline and heat and that shows unusual promise in polyvinyl chloride cable compounds, cable lacquers, wire enamels, vinyl resin fabric coatings, hot-melt compositions, aircraft gaskets and caulking and sealing compounds, is announced by Resinous Products & Chemical Co., Philadelphia, Pa.

The new resin is a saturated polyester, thermoplastic and chemically stable. It has proven unique as a plasticizer for Buna N type stocks and it is now being used in nitrocellulose lacquers. Experiments now being made indicate it may be used in many types of resistant coatings which come in contact with foods as can linings and hot-melt or lacquer type castings for frozen food wrappers.

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● AT LOWER COST ●

BECAUSE of the exquisite precision work and precision construction of the H-M you drill holes cleaner, faster, cheaper . . . *and save time, too.*

for holes .004 to .250" diameter

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The HAMILTON MUEHLMATT Super Sensitive DRILLING MACHINE

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Large Quill

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(counter balanced, hardened and ground)

6 SPEEDS

250-3000 RPM

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½ H. P. Motor

Specially engineered by RUSNOK to meet the demand for heavier duty end mill operations. Uses many types of cutters on a wide range of work. Large size spindle (No. 9 B & S taper). Takes ⅛" to ¾" end mills. Precision Engineered and Ruggedly Constructed Throughout.

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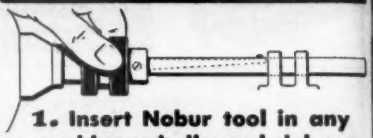
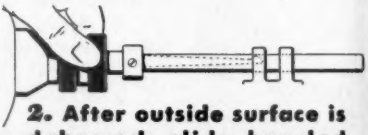
How to deburr holes faster!



1. Insert Nobur tool in any machine spindle and deburr outside surface of work.

Works like a drill—operator works with complete safety—parts can be burred as fast as they can be handled by operator.



2. After outside surface is deburred, slide knurled sleeve back to retract blade.

3. Move work on over retracted blade and deburr inside surface.

Double-edged cutting blade thus instantly removes burrs around holes in flat or curved surfaces of single or multi-walled parts—smoothly and accurately.

Send for deburring folder. Write

NOTE
All Nobur tools are now furnished with pilot shafts hard chrome plated!

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BAND AND DISC GRINDER

The latest in pedestal type grinders. Actually two machines in one! 14″ disc for all rough work . . . 6 x 48″ band for finishing. Precision-built to meet wartime production standards — quickly, economically!

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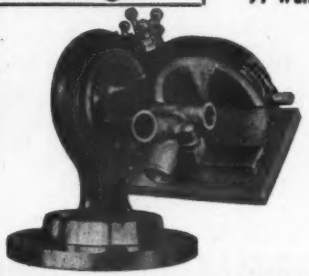

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The Studler Angle Computer so simplifies layout of die work, survey of castings, and inspection of precision-machined parts that users report it is doing the work in one-half to one-tenth of the time required by the sine bar method. Only one set-up is required. The work shown above was accurately surveyed in 15 minutes. Write today for Bulletin No. 2.

THE ANGLE COMPUTER COMPANY
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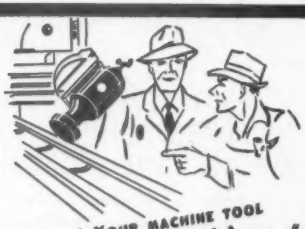
STUDLER ANGLE COMPUTER



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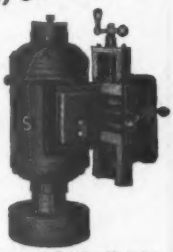

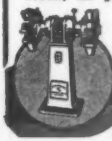

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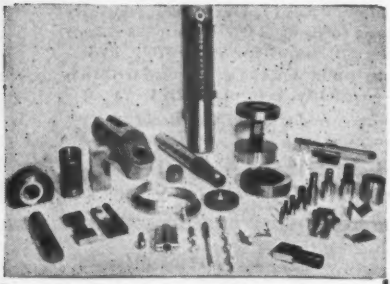

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They save 50 to 60% of the labor over hand methods.

Equally efficient on production filing jobs.

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STOPS LOSSES
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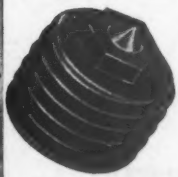

The Heimann Transfer Screw Set is a self-contained, complete tool. No wrenches or pliers are necessary. Made in 3/16" to 1" diameters.

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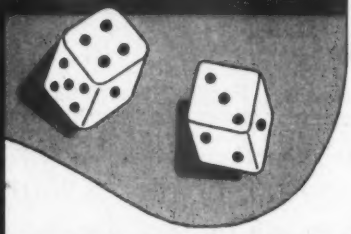

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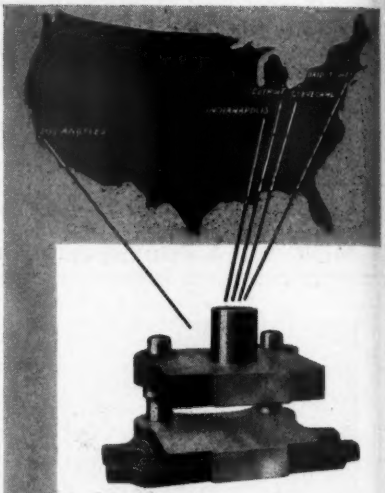

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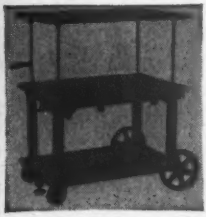

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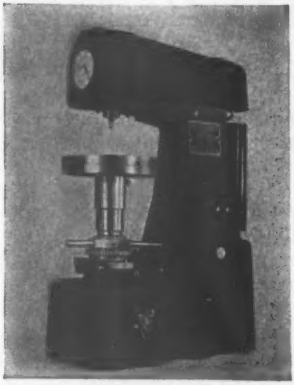

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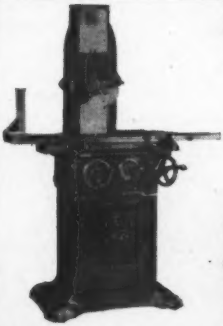

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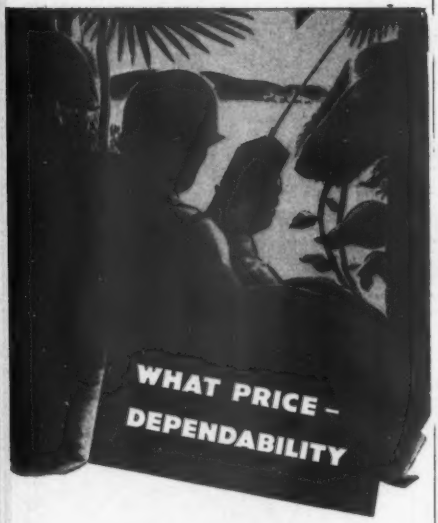

Communications demand dependability. No price is too great to pay for it, because failure at a crucial moment can cause the loss of thousands of lives. . . Dependability is no less vital in the tool and die industry where Kold-Hold cold temperature machines are establishing performance records.

Shrink fits, stabilization, aging and hardening of metals, tensile strength tests and processing requiring sub-zero temperatures are efficiently handled by Kold-Hold industrial units. Features include rapid heat extraction that permits speed-up of production, rugged design for heavy duty, self contained, no recharging or refilling required.

Productioneering* will help determine what capacity and temperature range best suited to your particular needs. . . Write at once for S-Z 431 catalog or personal call by field engineer.

KOLD-HOLD

Engineered for Production

145 North Grand Avenue Lansing, 4, Michigan

Sikorsky Aircraft Has First Helicopter Production Line —More Are On Way

Shortly after the war's end, you may be able to commute by helicopter, or reach the airport from the downtown section by one of these "feeder air busses", but don't count on owning your own helicopter fliover unless you're prepared to spend about $5,000. That's the price per helicopter that is expected to hold until sometime after peace returns.

Nevertheless, the helicopter is here to stay—unless all signs fail. Already, the Sikorsky Aircraft division of United Aircraft Corporation at Bridgeport, Conn., is operating a helicopter production line, the first in this country, and probably in the world.

It is reported that Sikorsky has produced helicopters for the Materiel Command of the Army Air Forces, for test use in Burma, evacuating wounded from the jungles; in patrol work along the Atlantic Coast; in Alaska.

Now coming off the production line is the company's XR-4. A heavier load-carrying model, the XR-5, is expected by fall. This helicopter will be powered by a 450-hp. Pratt and Whitney motor, will carry a pilot and passenger in tandem, fly faster than 110 miles an hour, with a range of about 400 miles.

Bus transportation companies see the big possibilities of helicopters for short-flight air "bus lines". Already 70 of

(TO PAGE 228—PLEASE)

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DESIGNERS AND MANUFACTURERS OF DIES · TOOLS · GAUGES · JIGS AND SPECIAL MACHINERY

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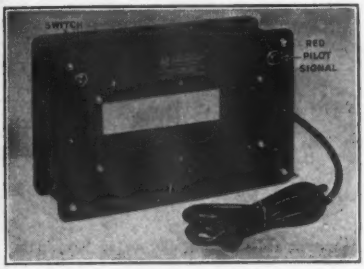
DENISON AND WEST 14TH STREET CLEVELAND OHIO 1826 COLUMBUS ROAD

AMC DEMAGNETIZER

A Tool Room Necessity



Every tool room needs this simple, portable, sturdy demagnetizer. Small parts passed through the powerful AMC field are instantly demagnetized. Large, flat surfaces can be demagnetized by sliding the device over the surface.

Available for either 115 V. or 220 V.

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DRILL JIG BUSHINGS

Behind this line are the special skills and experience derived from the successful manufacture of "Precision" Collets and lathe attachments . . . On a production basis for the first time, "Precision" Drill Jig Bushings have been made widely on special order for two years.

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GENERAL DIE-STAMPING-TOOL CO.

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The most complete catalog of its kind. Lists 5000 different shapes, sizes and cuts of GROBET Precision Swiss Files. Ask also for catalog YM on files for filing machines.

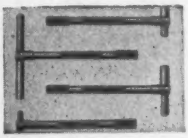
Learn more about these Chrome Steel Files that have won a reputation for utmost precision and durability—since 1812.

GROBET FILE CO. OF AMERICA, 421 Canal St., New York 13, N. Y.

BRAND GUARANTEED PRECISION TOOLS

BRAND TELESCOPE GAGES

are precision ground—all parts subject to wear are hardened—ground to proper radius.



Made in 4 sizes:

AA	⅛" to ½"..$2.10
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C	1¼" to 2½".. 2.40
Set of 3 (A,B,C) w/case	7.30
Set of 4 w/leatherette case	9.10

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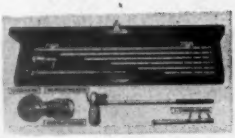

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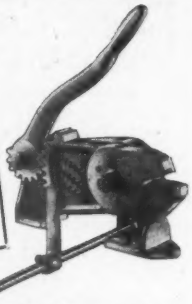

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The best Layout Dope on the market { Gallons . . . . . $ 2.50 / Quarts 90

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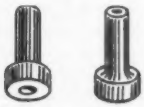
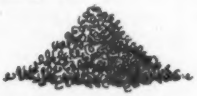
Here are two tubular parts, exactly alike . . .



One, bored out of a solid bar of tool steel, cost $28.40 to make. The other, sawed from a bar of **BISCO** tool steel tubing, cost only $9.10.

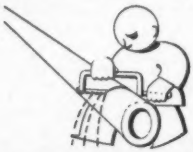
The difference is represented by a pile of scrap . . .



. . . which cost $19.30 to produce! It also cost the manufacturer precious hours of man-time and machine-time which he could have used more profitably.

THE MORAL!

Let's saw instead of boring!



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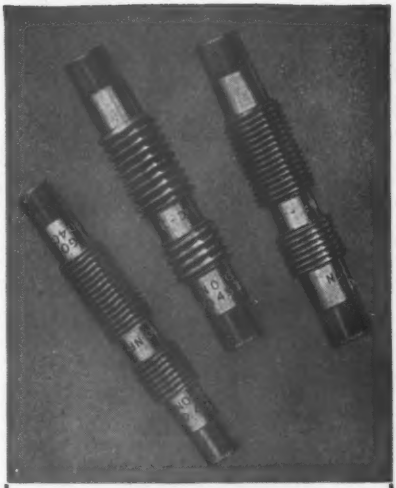

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Save time by eliminating the wringing together of "Jo" blocks to obtain a correct size. Choose the proper size Thred-Master, select the right wires, and you are ready to go.

Save wear on "Jo" blocks. Keep your blocks for reference purposes only. Use Thred-Masters to set up electric or visual amps and roll thread snap gages.

All Thred-Masters conform to N.S.T.C. standards (class 2 and 3 fits) and consist of both Go and No Go members. Their sizes range from 10-32 NF to 1" — 8 NC inclusive. They are made to "W" tolerance accuracy on pitch diameter, lead, and thread angle.

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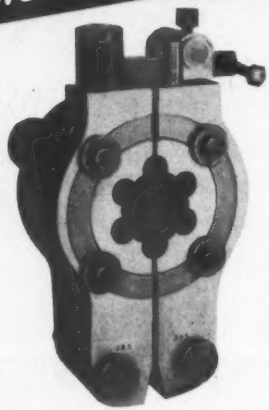

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Accurate speedy thread cutting is assured with these DIE HEADS. A wide range of capacity of each size die head means a small investment and makes this modern DIE HEAD the ideal general purpose thread cutting tool.

For tough threading jobs where constant uninterrupted operations are essential, use BHICO DIE HEADS.

No fussy adjustments to be made. Dies removed by loosening of two screws. When ordering BHICO DIE HEADS, specify DIE HEAD size and diameter of shank.

Ask your Dealer, or order direct.
Write for Details, Circular T-1

B-H INSTRUMENT CO.

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(CONTINUED FROM PAGE 224)

them have filed applications with the Civil Aeronautics Board to operate helicopter bus lines.

Among the companies with plans for manufacturing helicopters for peacetime use are Bell Aircraft Corporation of Buffalo, New York, and Higgins Industries, Incorporated, of New Orleans.

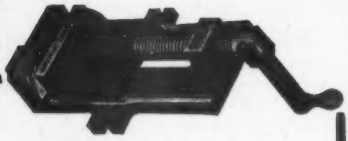
Bell has announced development of a new helicopter incorporating principles which make for stability in flight and for precision control, incorporating principles developed after many years of reasearch by Arthur M. Young, who heads the helicopter program for the corporation. It is one of the products which Bell expects to manufacture for both commercial and private use after the war.

Aside from the factor of cost, the Bell Aircraft Corporation warns that the future of the helicopter can only be impaired if it is oversold and if too much is expected of it, pointing out: "The helicopter is still in its early stage of development. It is likely that the developmental work can be carried on more readily than was the case with the automobile, however, and, in fact, helicopter research has been intensified at this time by the pressure of war."

A major improvement, developed by Mr. Young, is a stabilizing system which is incorporated in the Bell helicopter. In these craft the rotor is rendered independent of the mast by the stabilizing device and the rotor tends to remain in a horizontal plane. This stability promises increased simplification of controls when such craft can be made available for the general public.

The two-bladed rotor used on these helicopters also makes possible a simplified hub design.

The Bell machine uses a conventional anti-torque propeller on the tail and has a three wheel landing gear. The Franklin engine, rated at 160 hp, is of the horizontally opposed air-cooled type, and is mounted vertically directly aft of the pilot's compartment. The closed cabin model utilized generous sections of transparent plastics with the cabin design affording maximum vision. A6S-M



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This new Yost vise has been designed expressly for use on drill press operations. Does away with special and costly jig fixtures.

Offered in two sizes.

Vise No.	Width of Jaw, Inches	Opens Inches	Weight Pounds
1D	3½	3½	12½
2D	5	5½	23

Do you need a vise of ANY type?

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Scientifically selected to conserve critical alloys and meet the requirements of the AIRCRAFT, ORDNANCE, and MACHINE TOOL industries.

Complete "EARMARKED" stocks of Aircraft alloy steels at Buffalo and Detroit.

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FOR TOOL, DIE, PATTERN OR TEMPLATE LAYOUT ON METAL

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All diamond sizes ¼ to 10 karat are nib mounted for immediate shipment . . . Billed subject to approval. Specify quality of diamond wanted. We recommend a minimum size of one karat for each 6" diameter of grinding wheel. (24 hour resetting service, $1.00 post paid.)

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40 years doing one thing exclusively—**making good tool steel.**

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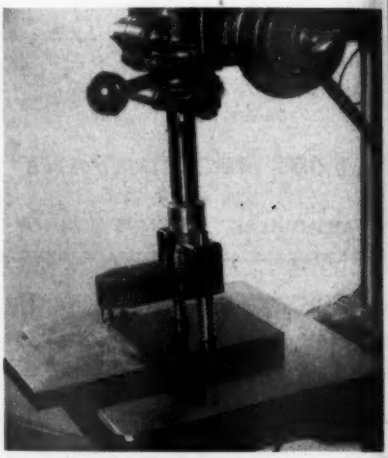
Back Spotfacing Device

A labor-saving production or toolroom device, an offset drill head, for quick, efficient back spotfacing operations on parts where the holes to be spotfaced or countersunk are inaccessible to a standard tool mounted directly in the drill press spindle, is announced by Edlund Tools, Inc., Dept. TD, 4473 Woodward Ave., Detroit 1, Mich.

The tool is estimated to save 75 percent of labor time as compared to the conventional procedure in back spotfacing. The offset drive permits back spotfacing with the same speed, ease and accuracy as ordinary spotfacing.



The tool is essentially a body casting into which is built spur gear trains which transmit the rotational movement of the drill press spindle to the spindle in the "nose" end of the casting to which the cutter is attached. The cutter spindle is rigidly mounted in a combination of ball bearings and needle bearings for maximum radial and thrust support.

The offset drill head is mounted in any standard drill press like a drill chuck by means of a Morse taper shank. If an old drill press with run-out is used, a floating tool holder is recommended to be installed between the spindle of the drill press and the drive shaft of the tool to correct misalignment. A62-M

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The McGrath Vernier Caliper has an adjustable head and jaw, making possible any two Vernier adjustments at any point on the scale. The adjustable end jaw is a time saver and eliminates inside measurement errors.

This instrument can be set up on machine tools, surface plates, or other appliances wherever two limits are necessary. Write for our new complete Precision Tool catalog.

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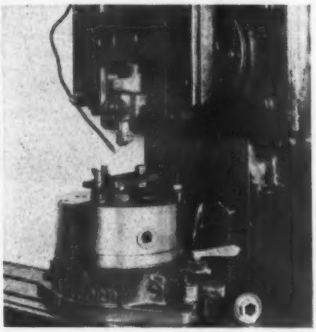

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The versatile Super-Spacer is a toolroom favorite because of its simplicity, ruggedness and accuracy. Very accurate multi-splines are being slotted in hard heat-treated steel; a special holding fixture is mounted on the face of the chuck.

Design and application bulletin on request.

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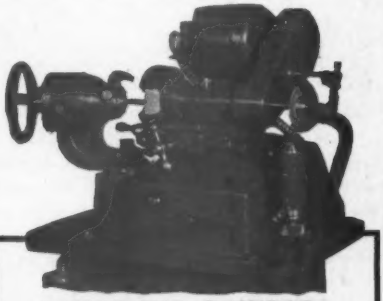

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55,000 RPM

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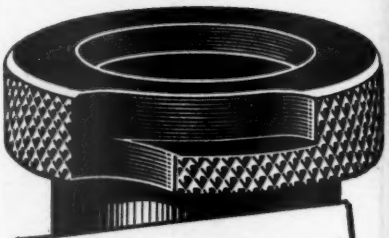

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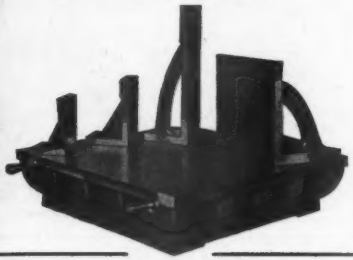

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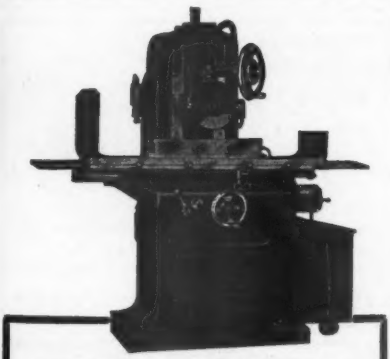

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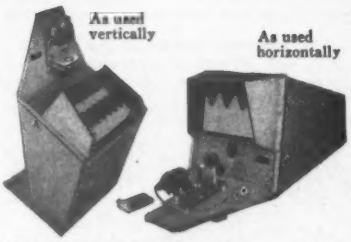

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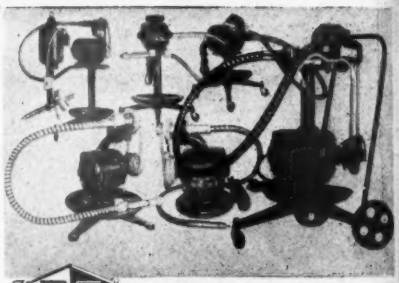

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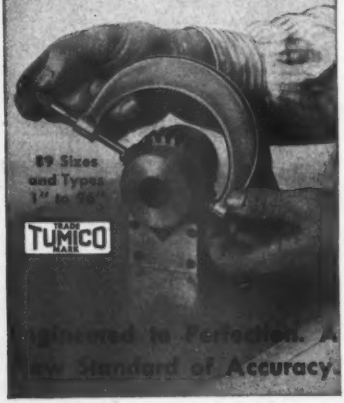

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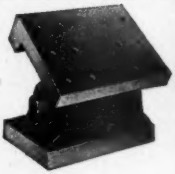

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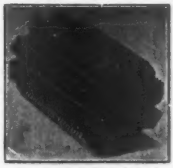

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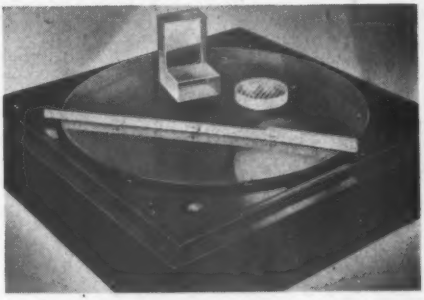

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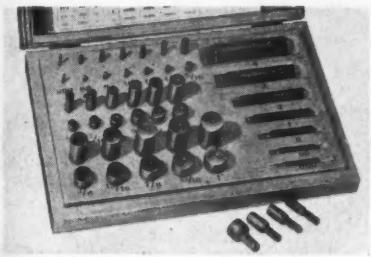

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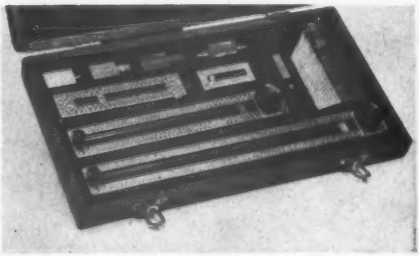

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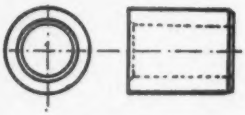

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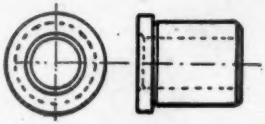

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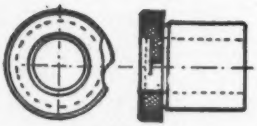

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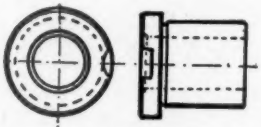

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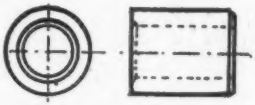

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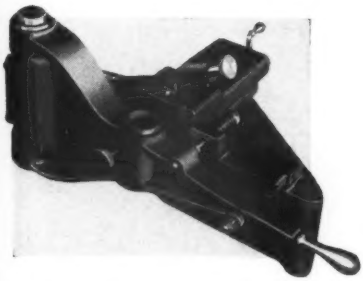
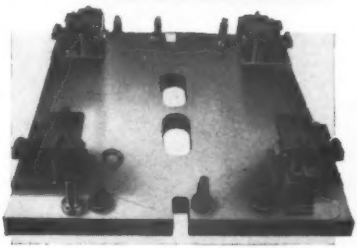
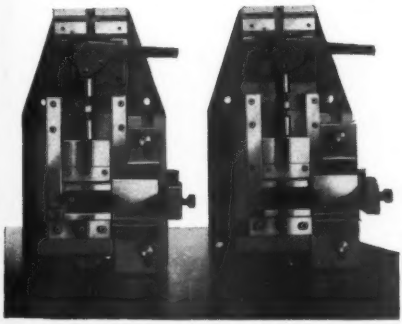
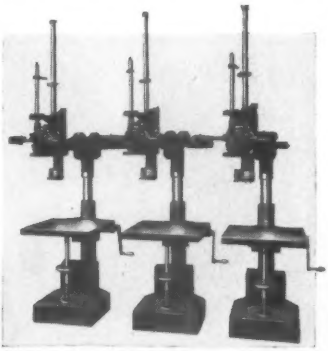
The fixtures shown on this page are typical of many which have sprung from Sommer & Adams' more than 25 years' acquaintance with actual requirements in the field. Fixtures for checking, milling, drilling, tapping, grinding and other purposes are at your call. They are marked by interchangeability of parts, accuracy and high production possibilities.









We'll be glad to help you plan your tooling program.

THE SOMMER & ADAMS COMPANY

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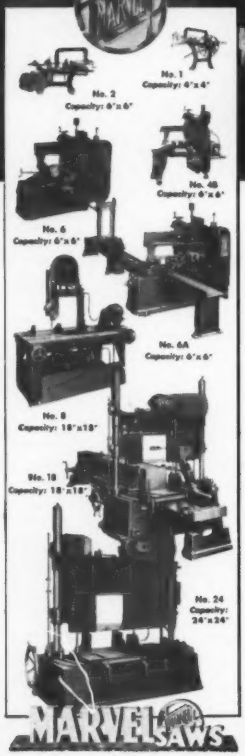
Custom-Built EQUIPMENT FOR MANY PURPOSES



Part of the row of No. 18 MARVEL Giant Hydraulic Hack Saws used to crop and cut-off test slices for metallurgical tests for large billets of tough alloy steels

MARVEL No. 18 HYDRAULICS

12 in a row!

When a greatly expanded steel plant, near Canton, Ohio, faced the problem of cropping and cutting-off test samples from large alloy billets, in *wartime* quantities and at wartime speed, they checked the performance of all types of cutting-off equipment in all their other company plants, and selected MARVEL No. 18 Giant Hydraulic Hack Saws for this "tough" job.

Now this row of twelve MARVEL No. 18 Hydraulics shown above, operating continuously, 24 hours a day on tough alloy billets of from 14" to 16" cross section, handle this tremendous, heavy duty cutting-off job without a hitch and with a minimum of man hours — only four operators per shift.

When you have a cutting-off problem your most logical first step is to check with your local MARVEL Sawing Engineer for recommendations of methods and equipment.

ARMSTRONG-BLUM MFG. CO.

"The Hack Saw People"

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